User-Reported Problems
October 2012 – August 2013

Resolved User-Reported Problems

- **(06002, 1/06)**
  - REPORTED BY: Bill Arcieri, ISL
  - DESCRIPTION: Bill reported that there are some commented out lines in subroutine RKINO for the variable 'cfr' that affect the results for a Bettis problem on version 2.4.1. They were under 'ifdef cradakin' in version 2.1.4. The change was traced to the making of version 2.3.0; for this version, Walt Weaver was putting in the radionuclide transport coding and making the cradakin changes permanent for a future IRUG release (version 2.3.6). He got different results on some test problems and commented the lines out (it is done in subroutines IRKIN and RKINO).
  - STATUS: RESOLVED (RAR, WLW, ISL) Walt thinks we need a new 'ifdef'. ISL corrected this problem by reinstating the commented coding and implementing a new 'ifdef' – rodcusp.

- **(06030, 5/06)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: While debugging problems associated with new helium (hen), it was noticed that subroutine STVNPX uses a technique to reuse the same scratch space in comdeck SCRTCH.H. The answers are correct, but the coding technique can lead to confusion. It is recommended that scratch variables "paa, pbb, taa, tbb" be moved from slots 77-80 to slots 82-85, and thus they will not overlap with the transport properties.
  - STATUS: RESOLVED (NAA) The scratch variables are no longer stored in slots and are allocated individually, the problem is resolved.

- **(06039, Low, 07/06)**
  - REPORTED BY: Justin Talley, U. of Missouri-Rolla
  - DESCRIPTION: When using the reflood option, there is no input checking when boundary condition 2XXX, 3XXX, or 4XXX is specified on the reflood side of the heat structure (should be an input error). Vol. II, Appendix A also needs to be changed to indicate this is an input error. This was found in RELAP5-3D version 2.3.6; this affects all earlier and all later RELAP5-3D versions.
  - STATUS: RESOLVED (RAR,NAA) Verified this by modifying the installation deck reflood.i to specify heat flux (type 2XXX) on the reflood side. The calculation failed with a floating point exception in subroutine DITTUS [called from subroutine HTRC1; called from subroutine QFHTRC (reflood side heat transfer)].
    Added input checking to subroutine IRFLHT for types 2XXX, 3XXX, and 4XXX on the reflood side; tested correctly.
    Examined the non-reflood side. Tested boundary condition type 1000;

code fails in subroutine HT2TDP. Walt Weaver found similar errors in subroutine HTRC2 for such types when doing the 2D conduction work; he fixed these errors (thus this non-reflood side error will be fixed by Walt's updates). As part of the 2D conduction work, Walt also wrote a new subroutine ITODHT that replaces subroutine IRFLHT. Next to submit the IRFLHT changes to the next version of the code that includes subroutine ITODHT.
Found that the updates are not needed, as the reflood model can be used for these boundary condition types as long as a boundary volume is present. The manual was updated to indicate this as an option.

- **(06040, 7/06)**
  - REPORTED BY: Rich Riemke, INL
  - DESCRIPTION: In modifying the coding to use the module RTRNMOD, the installation test problem rtsampn.i was modified to only use case 2 (nodal kinetics, semi-implicit scheme, default solver). This was used to test the modified coding. For this test problem, all the parts of the major edits (volume block, junction block, etc.) were present, with or without the update. When the full test problem was used (cases 1, 2, 3), the volume block was not present for cases 2 and 3, with or without the update.
  - STATUS: RESOLVED (RAR,NAA) checked earlier versions of the code since this deck was first introduced in version 2.3.6; all versions (2.3.6, 2.4.1, 2.5 series) exhibit this problem. Continued to debug the coding (why variable 'vctrlx' is 0). Traced the problem to subroutine ICMPN1, where the first bit of 'vctrlx' is either set to 0 or 1. The setting of the bit depends on calls to environmental library functions and subroutines; currently examining these. Continued to debug the problem [why 'isfdes(-1.0)' is 1]; looked at the bits in the variable 'print'. Did writes in subroutines ICMPN1 and RNEWP. Reran the problem with card 5 input in all 3 runs with the latest writes in subroutine ICMPN1; still getting 'isfdes(-1)' equal to zero for case 1 and equal to one for cases 2 and 3. Added calls to subroutine FILDMP in subroutine RHELP and ICMPN1 to examine storage information. Continued to analyze the debug writes. Read subroutine IDFIND and function ISFDES; doing writes in subroutine IDFIND. Continued to analyze and do more writes in subroutine IDFIND. In subroutine RHELP found that cards 2 – 5 are set. It was found that variable 'l3a(1)' is set to the card number to be read in (i.e. 2 – 5). Deck rtsampn.i uses card 5, and when the second case begins, variable 'l3a(1)' is set to 5 instead of 2 as it should. Added a statement at the beginning of the routine to set 'l3a(1) = 2'. The problem now runs correctly and the volume block is printed. As a consequence found that input deck typpwrr2.i also had the same problem which is now resolved for both decks.

- **(06041, Low, 07/06)**
  - REPORTED BY: Ryan Dalling, BYU-Idaho

- DESCRIPTION: In running a lead-bismuth and CO_2 problem, the code failed with a floating point exception in subroutine STRX1, which was called from subroutine JCHOKE. This was found in RELAP5-3D version 2.3.6; this affects all earlier and all later RELAP5-3D versions.
- STATUS: RESOLVED (RAR,NAA) The problem was traced to subroutine STRSAT; called from subroutine STRPX just before subroutine STRX is called. Added a lower limit (variable 'ttrip') on the calculated saturation temperature in subroutine STRSAT (also did it for subroutine STNSAT) as is done for the fluids h2o and d2o. Now the code stops with a thermodynamic property error at the minimum time step as expected, however the message from subroutine STATEP is missing. The version 2.4.1 STRSAT and STNSAT updates were sent to Bettis and ISL (Bill Arcieri, Glen Mortensen). The updates to subroutine STRSAT and STNSAT were submitted and will appear in version 2.8.1. A similar problem occurred in UP#08018. Debugged the thermodynamic property error problem.
  Found that a general table was used to represent a power source for the heat exchanger problem, this caused the temperature in the problem to continue to increase until the tpf table temperature was exceeded. Interestingly, it was found that the problem will run with the nearly-implicit scheme, it is believed that this is related to UP#07006. The issue is a modeling error, because this deck is not being actively modified, and Ryan is gone, this problem is resolved.

- **(06052, 10/06)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: The last print (in installation problem pump2.i) of the two-phase difference curve for torque regime 8 is wrong in the pumpblk database; it was clobbered by the start of the data for the second pump. The last point should be (0.0, – 0.15) (see RPUMP.F), but the – 0.15 value is missing.
  - STATUS: RESOLVED (NAA) Found that the last point is in the current version of the code, this problem is resolved.

- **(06054, 10/06)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: A dry (pure) helium noncondensable problem runs with working fluid water and fails with working fluid helium.
  - STATUS: RESOLVED (RAR,NAA) Continuing to debug the failure. The problem was run with version 4.0.3, and it ran successfully.

- **(06062, 11/06)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: A simple model of an EBR-II fuel assembly fails during execution. This input model specifies the heat transfer coefficient through a table. The problem runs if the convective heat transfer package is used.

The problem that fails runs on a special CO_2 version of 2.4.1.1 on the PC. This is probably a FORTRAN 90 problem.
    - STATUS: RESOLVED (NAA) This problem was run with version 4.0.3, and it ran successfully.

- **(06069, 12/06)**
    - REPORTED BY: Cliff Davis, INL
    - DESCRIPTION: A simple model that contains two stacked input problems fails on the second problem with Version 257 although the input is OK (It runs if the / card is commented out). Both problems run on Version 241. The error message in Version 257 (Heat transfer rate specified for both boundaries of heat structure 2100001 …) is not consistent with the input because the rate is specified for neither surface.
    - STATUS: RESOLVED (NAA) This problem was run with version 4.0.3, and it ran successfully.

- **(07003, 1/07)**
    - REPORTED BY: Bettis
    - DESCRIPTION: In using the nodal kinetics control information card 30000003 in a system calculation, word 16 (print control flag) was set to 0. The input manual indicates no printed output from the kinetics modules will occur if word 16 is 0. The output file, however, does show printed output from the kinetics module.
    - STATUS: RESOLVED (RAR, WLW) Bettis worked up an update to subroutine MAJOUT that uses the variable 'rkprnt' to skip around a call to subroutine NNKMOUT. The update was submitted and tested and worked properly.

- **(07009, 2/07)**
    - REPORTED BY: Cliff Davis, INL
    - DESCRIPTION: The output printout does not contain a listing of the feedback coefficients that the user input. Thus, there is no way for the user to tell if the input was read correctly. The needed print statements are included in the code, but have been commented out.
    - STATUS: RESOLVED (NAA) The coding was inspected and tested in version 4.0.3, and it is in place and prints as expected.

- **(07024, 6/07)**
    - REPORTED BY: Walt Weaver, INL
    - DESCRIPTION: While looking at the coding for the #ifdef simair in VIMPLT noticed that the corresponding coding for #ifndef simair is missing. This implies that the code should fail in an IRUG configuration where the sim ifdefs are removed. The code needs to be checked for similar restructuring errors – symptom - #ifndef followed immediately by #endif.
    - STATUS: RESOLVED (NAA) The coding was inspected in version 4.0.3

and the concerned coding has been corrected.

- **(07025, 6/07)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: While running an S-LH-1 test problem, the code failed on a material temperature out of range. The surface temperature changed over 600 K in one time step. The problem was caused by the user inputting $\rho C_p = 0$ and h = 0 because the mode was calculated to be 12. The code should verify that k and $\rho C_p > 0$ and generate a failure if they are 0.0.
  - STATUS: RESOLVED (NAA) Added error checking to test if a user entered a thermal conductivity or volumetric heat capacity less than or equal to 0.0. If the user enters a value less than or equal to zero, a failure occurs and a message is printed. Vol. 2 Appendix A was also updated to indicate that the user must enter a value greater than 0.0 for k and ρC_p.

- **(08016, 5/08)**
  - REPORTED BY: Pavel Hejzlar and Robert Petroski, MIT
  - DESCRIPTION: A problem was encountered on a re-node restart. 4x99 identical heat structures were added on restart (these were the lowest numbered heat structures in the renodalized deck). During the restart transient, HS 1014-045 – 1014-92 gave different results from the other identical HS. [The results were identical at 0.0 s, but not at 3.0 s during the transient]. Numbered sequentially, HS 1014-045-92 occupied the same positions as HS 8201-001-016 in the steady state run. The 8201 HS were the only ones using the radiation enclosure model in the deck.
    MIT was able to work around by changing the added HS geometry numbers to values that were greater than any in the steady-state deck.
    MIT probably replaced tpfms4 by tpfms5 (a new salt) in their calculations.
  - STATUS: RESOLVED (NAA) Found that the index locations used to point to HS-8201 were not updated on restart as they should be. The issue was traced to variable ‘jlr’ which is set to 0 or 1 in R-level, but set to the index locations in I-level. Added a new variable ‘ordlr’ to be set to the index location in I-level and used in the transient. This way values set in variable ‘jlr’ could be reused to correctly set the indexes for HS-8201. With the index error corrected, both the steady-state and restart decks were run and tested successfully, now the 4 identical heat structures get identical results at 3.0 s into the transient. This problem is resolved.

- **(08035, 10/08)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: The code fails on input if an uncoupled heat structure (i.e. one that does not affect the hydraulics tries to reference another heat structure for its geometry information, presumably because the input geometry (-2) does not equal the geometry of the referenced heat structure (+2). This was found in RELAP5-3D version 2.4.2; this affects all earlier RELAP5-3D versions back to version 2.0.3 and all later RELAP5-3D

versions.

- STATUS: RESOLVED (NAA) Found that the error is due to variable 'htopt' which uses bit packing. The 24th bit of variable 'htopt' initially stores the value of the input geometry (i.e. 1, 2, or 3). The 27th bit of variable 'htopt' is then set if the heat structure is decoupled from hydrodynamics. The code later tests on the value of variable 'htopt' and because they were set differently, the code sees them as not being compatible geometry types. Added a logical variable 'ht_decpl' to be set to true if the heat structure is decoupled. The use of the 27th bit of 'htopt' was then replaced with a test on variable 'ht_decpl'. This caused the value of 'htopt' to be the same when they are tested, so the code views them as compatible geometry types and resolved the issue.

- **(08037, Low, 10/08)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: The built-in Westinghouse homologous pump curves have discontinuities between regimes 2 and 8 at an independent variable of 0.0 and between curves 5 and 7 at an independent variable of 0.0. The built-in curves for regimes 7 and 8 are just constant values of 0.0. It would be better if they matched up with curves 5 and 7 at an independent value of 0.0. The discontinuities will cause oscillations in pump performance if the user allows reverse pump speeds. This was found in RELAP5-3D version 2.4.2; this affects all earlier and all later RELAP5-3D versions.
  - STATUS: RESOLVED (Epiney) Checked "Bingham" head and torque curves => they are all continuous. Checked the curves for the difference between single and two phase flow => they are all continuous. Checked "Westinghouse" head and torque curves. Found the discontinuities Cliff reported in the head and torque curves. The curves were made continuous at w/q = 0. This resolves the issue.

- **(08047, Low, 12/08)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: A test problem was developed for a training exercise with the multid component. The downcomer component had 1 ring, 4 sectors, and 6 levels. The geometry was perfectly symmetric except that the flow was provided to only one ring at the top of the downcomer. The outflow connections at the bottom of the downcomer were symmetric. The theta flow at the top level was not symmetric although it should be. When the inlet junction was connected to a theta-face, instead of an r-face, the flow became symmetric. There may be an error in the 1D to 3D connection logic. This was found in RELAP5-3D version 2.4.2; this affects all earlier and all later RELAP5-3D versions.
  - STATUS: RESOLVED (CBD, RAR,NAA) Cliff modified the input deck to use Card CCC0001, Word 7 = 1 (normal 1D momentum equations are used on each of the coordinate directions); the theta flow at the top level became symmetric. Modified the test deck so that there was only 1 level,

the flow is still not symmetric. Also modified DA deck radial.i to have flow provided to only 1 ring, also not symmetric. Found that the upwind velocity for the 4th ring was not set correctly. Set the upwind velocity to the expected value, and the flow became symmetric. The update tested correctly. Tried connecting the inlet flow to the second theta volume, the flow was no longer symmetric. Found that due to the structure of subroutine FLUX3D, the 1st theta volume doesn't know about the upwind velocity in theta volume 2. Added an internal subroutine that allowed volume 1 to know about the velocity in volume 2. The flow became symmetric, and is now the same regardless of which theta face the flow is attached to.

- **(09004, Low, 2/09)**
  - REPORTED BY: Bettis
  - DESCRIPTION: In running a system calculation, the pumps can windmill (at times) even when the pumps are off. Bettis provided the fix. This was found in RELAP5-3D version 2.4.1; this affects all earlier and all later RELAP5-3D versions.
  - STATUS: RESOLVED (NAA) Applied the Bettis fix and it tested successfully.

- **(09009, 2/09)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: The DA test case, radial.i, which is used to test the MULTID component with the semi-implicit scheme, was modified to give an asymmetric flow boundary condition. Radial flow entered at the outer ring only in sector 1. The radial flow in the other 5 sectors was set to 0.0. The results should be symmetric in the θ direction (i.e., flow from Sector 1 to 2 should match the flow from Sector 6 to 1 except for sign); however, the results were not symmetric. Also, the calculation failed at ~15 s due to a velocity spin-up. This problem is probably closely related to UP#08047. This was found in RELAP5-3D version 2.8.6; this affects all earlier and all later RELAP5-3D versions.
  - STATUS: RESOLVED (NAA) Ran the modified radial.i deck after fixing UP#08047, found that the results were nearly symmetric. The plots look symmetric, but when looking at velocity values, there was at least a 5% difference from symmetry. When UP#13006 was corrected, this problem was resolved as well.

- **(09036, 6/09)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: An MHI engineer reported a code failure while working on the simple insurge problem described in UP #09035 with a very detailed steam table. The problem was traced to a pressure/temperature pair that resulted in a vapor state very close to the sat line. When the state is too close to the sat line, the generator sets the single-phase properties to

those of saturated liquid and identifies the state as “sat-liquid”. Subroutine STH2X6 then uses a liquid property when trying to determine vapor properties in this region. This resulted in bad properties, excessive mass error, and a code failure. The problem can be fixed by changing the P/T values in the new steam table. However, the current steam table has the same potential problem near the critical point, with $21.78 \leq P \leq 22.12$ MPa and $T > 646$ K. The .pr files for many of the ATHENA fluids also have some points that are identified as “sat-liquid”, which implies that vapor properties in this region could be bad. Note that the “sat-liquid” logic also applies at the triple point and critical points. The logic is probably appropriate at the critical point, but could cause problems near the triple point. This was found in RELAP5-3D version 2.4.2 plus updates; this affects all earlier and all later RELAP5-3D versions.

- STATUS: RESOLVED (NAA) In talking to Cliff, he indicated that points with “sat-liquid” could be ignored for both triple and critical points. Found that fluids BiPb, blood, glycerol, Li, NH3, MS1, MS2, MS3, and MS4 had points that were identified as “sat-liquid” that were not at the triple or critical points. For fluids BiPb, Li, NH3, and MS[1-4] the table temperatures were modified slightly so that there would be no “sat-liquid” states at these points. For blood and glycerol a table pressure was removed for both fluids because it was only slightly different than the critical pressure (~7e-5 %). The only “sat-liquid” points left in the *.pr files are at critical and triple points.

- **(09038, 7/09)**
  - REPORTED BY: Bettis
  - DESCRIPTION: A transient run 20 seconds was compared with one run 10 seconds and restarted. There are differences in the last bit of some variables even on the first step of the restart. Mass error is different on major edit at time of restart; 3.45e-4 vs. 3.59e-4 on Bettis’ problem. This was found in RELAP5-3D version 2.4.1 plus the improved timestep control updates; this affects all later RELAP5-3D versions that have the improved time step control updates.
  - STATUS: RESOLVED (GLM, RAR,NAA) Rich Riemke helped George Mesina debug the problem. Found that the mass error was different because subroutine IMLP zeroed out the mass error at the beginning of a restart case. Modified subroutine IMLP so that the mass error would not be zeroed at the beginning of a restart, this problem is now resolved.

- **(09053, 9/09)**
  - REPORTED BY: Peter Cebull, INL
  - DESCRIPTION: Pygmalion (Pygi) will not work with the new restart/plot file format. This was found in version 2.9.3; this affects some earlier RELAP5-3D versions.
  - STATUS: RESOLVED (Forsmann) The Pygi program was updated to work with version 4.0.3.

- **(09064, 11/09)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The jet junction model (specified as junction flag ‘j’ = 1) is only allowed to be used in a single junction component. The model is not to be used at other hydro components that contain a junction. Currently, only the time dependent junction does error checking for ‘j’ = 1 in subroutine RTMDJ and flags it as an error if ‘j’ = 1. The other R-Level hydro component subroutines that contain a junction that do not allow a jet junction need to have the error checking coding in RTMDJ. This was found in version 2.9.3; this affects all earlier RELAP5-3D versions and this was found in some RELAP5/MOD3 versions.
  - STATUS: RESOLVED (Epiney) Went through all r-level routines containing junctions and found that errors on the ‘j’ flag are actually captured by checks on the subsequent ‘e’ flag. For better readability of the code, explicit checks on ‘j’ have been added to the all junction check routines:
  - Subroutines RSNGJ and RCPLJUN already had a check, because ‘j’ is allowed to be 0 or 1 for single junctions and PVM junctions.
  - Subroutine RTMDJ already had a check.
  - For all other components, an explicit check on ‘j’ has been added.
  - For subroutines RPMVNJ and RCPVNJ: These files only checked flags up to ‘f’ since for turbines and compressors, only e = 0 is allowed. => a check on ‘f’ captured errors on ‘j’ and ‘e’ as well. In addition to the check on ‘j’, a check on ‘e’ has been added for the turbine and compressor files.

- **(09069, 12/09)**
  - REPORTED BY: Peter Cebull, INL
  - DESCRIPTION: Problem fails at ~1964 s because heat structure temperature drops below the range of the heat capacity table. This generates erroneous error messages about empty single phase homologous curves for all the pumps, the message “Just bypassed edit time,” and a final major edit fails to be generated. This was found in RELAP5-3D version 2.9.3; this affects some earlier RELAP5-3D versions.
  - STATUS: RESOLVED (RAR,NAA) Tested this on version 2.4.2is; the calculation also fails at ~1964 s because the heat structure temperature drops below the range of the heat capacity table. This version correctly does not generate the erroneous messages about empty single phase homologous curves for all the pumps, the message "Just bypassed edit time," and a final major edit fails to be generated. Traced the empty single phase homologous curves message in version 2.9.3 to subroutine PUMP2; modified subroutine PUMP2 to use a new local variable 'tfail' if a pump table is empty instead of the variable 'fail'; reran the calculation with this change; the empty single phase homologous curves message no longer appears. Versions 2.4.1 and 2.6.2 are correct and do not need the update. Sent the update to version 2.9.3 to Bettis and ISL. The update was

submitted and will appear in version 3.0.0. The problem runs to completion with version 4.0.3, this problem is resolved.

- **(10011, 1/10)**
  - REPORTED BY: Rich Riemke, Cliff Davis, and Paul Bayless, INL
  - DESCRIPTION: In version 2.5.8, a change was made to subroutine RRESTF to require the title on the restart input deck to be the same as it is on the initial input deck; if the titles are not the same, an input error occurs. This was put in the code for PVM. This restriction causes trouble with code users, who often run a steady state initial input deck and then run many transient restart input decks from the end of the steady state. The users use the title card to indicate what a particular restart input deck does. This restriction does not allow the users to use the title card for this purpose. This was found in RELAP5-3D version 2.9.3; this affects some earlier and all later RELAP5-3D versions.
  - STATUS: RESOLVED (Epiney) The following changes have been made:
  - RELAP compiled with PVM coding:

    If the problem is PVM coupled during execution => Problem name in the restart has to be the same as the simulation name received from the Executive, otherwise error.

    If the problem is not PVM coupled during execution => Problem names in restart and input can be different, and just a warning is printed.
  - RELAP compiled without PVM coding:

    Problem names in restart and input can be different, just a warning is printed.

- **(10054, 8/10)**
  - REPORTED BY: Bettis
  - DESCRIPTION: In running a system calculation on a Windows PC using the multiple junction component, the code failed in input processing due to using -1000000 for Word 11 (‘To’ volume increment) on the multiple junction geometry card CCC0NNM. This was found in RELAP5-3D version 2.4.1; this may affect some earlier and some later RELAP5-3D versions.
  - STATUS: RESOLVED (RAR,NAA) Bettis faxed me a simplified input deck that shows the problem. Nolan tested it on version 2.4.1 on a Linux workstation and Windows pc; I tested it on version 2.4.2 on a Unix workstation. We verified what Bettis found; the problem runs on Linux and Unix, but it fails on Windows. Bettis and Nolan found the input error message was in subroutine ISNGJ ('To' volume pointer for component 5, has incorrect code); the volume pointer printed out from subroutine RMTPLJ is incorrect. Discussed the problem with Bettis; they suggested this may be related to UP#05031, that was reported by Glen Mortensen (ISL) in 2005; this problem was unresolved and Glen indicated the problem failed because of the bit 19 flip that Intel and AMD does on their chips to convert a signaling Nan to a quiet Nan. At the time, Glen

indicated that ISL had fixed the problem (fairly large update) in the NRC version of RELAP5. In 2007, Dick Wagner emailed Glen and me his findings on this subject and that some coding 'tricks' may have caused the problem. Dick suggested the coding 'tricks' that caused this problem may have been removed by the Fortran 95 work. Nolan tested the problem on Fortran 95 version 2.9.3 on Windows; the problem runs correctly.

- **(12028, 9/12)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: An MHI engineer reported a problem with the clad deformation model. The code resets the crossflow junction area to the minimum x-direction flow area of the adjacent volumes for each crossflow junction on the first time step. A review of the coding in subroutine VARVOL shows that the deformation model was developed assuming flow in the x-direction. The model does not currently account for the possibility of crossflow. This code error affects all versions since RELAP5/MOD3.
  - STATUS: RESOLVED (CBD) Cliff corrected the coding so that it now accounts for crossflow. This problem is resolved.

- **(12031, 10/12)**
  - REPORTED BY: Gerhard Strydom, INL
  - DESCRIPTION: The use of nodal kinetics without a control rod model present seems problematic. Vol. 2 Appendix A (Sect. 15-19) of the user manual indicates that cards 33000000 are optional, but the user had a problem if they are not defined. The code exits without any indication of the problem. The code exits with a “segmentation error” message – no indication is given in the output file or screen dump where the problem was.
  - STATUS: RESOLVED (NAA,DB) Commented out the 33000000 cards in input deck hex2d.i and the code crashed with a segmentation fault. Passed this problem on to Doug Barber at ISL and he added some coding to check whether the problem had control rods. This change fixed the failures due to having no control rods.

- **(12033, 11/12)**
  - REPORTED BY: Jason Williams, B&W
  - DESCRIPTION: A restart problem fails when the capability to control a time-dependent junction with a control variable is added on restart. The traceback points to subroutine IREQUEST.
  - STATUS: RESOLVED (NAA) The input decks with the failure were unavailable, so tried various configurations to try to get a problem to fail to identify the issue, and have not been successful with a time-dependent junction. Jason indicated they were getting the same failure when a pump was controlled by a control variable, after altering the cstest1.i and cstest2.i decks I was able to get the failure to occur for me. Found that

some control variable variables were being used before they were allocated on a restart. Modified the coding in internal subroutine REQCNV in IREQUEST so that non-allocated coding could not be accessed. This corrected the issue, and I sent the fix to Jason and others.

- **(12034, 11/12)**
  - REPORTED BY: Scott Lucas, NuScale
  - DESCRIPTION: The POWERX control variable is not working correctly for a transient problem. The error was confirmed with hand calculations.
  - STATUS: RESOLVED (NAA) The error was found in subroutine CONVAR. The POWERX function is 'case(14)' within the subroutine – there is a do loop that loops over the variable l = 1, 2, but the variables 'var' and 'ptr' use an index of '1' instead of the loop index 'l'. The coding was changed to use the correct index and the problem was resolved.

- **(13001, 01/13)**
  - REPORTED BY: George Mesina for Ken Jones, APT
  - DESCRIPTION: SNAP users can no longer modify the transient as it runs through the SNAP interface. Requires activation of the "snap" and "wincvf" precompiler directives.
  - STATUS: RESOLVED (GLM) "snap" and "wincvf" were activated in the define file and envrl subroutine was modified to compile with "wincvf" active.

- **(13002, 01/13)**
  - REPORTED BY: George Mesina for Carlo Parisi, ENEA
  - DESCRIPTION: Carlo found that he could not run some large problems that ran previously with version 2.4.2. Variable 'nhld' in subroutine INPUTMOD was set by Dick Wagner to 100,000 lines of input. This was less than the 190,000 that Carlo needed.
  - STATUS: RESOLVED (GLM) Variable 'nhld' was reset to 500,000.

- **(13003, 01/13)**
  - REPORTED BY: George Mesina for Scott Lucas, NuScale
  - DESCRIPTION: When running a large problem with version 4.0.3, Microsoft Visual Studio reported that relap5.exe triggered a breakpoint in subroutine LEVSKT at statement:

    ```
    if (jtop.ne.0.and.ibits(jtop)%jc,8,1).eq.1) then
    ```

  - STATUS: RESOLVED (GLM) The if-test was split into two with the 1st clause as the outer if. This prevents the second clause evaluation, when it should not be, on compilers that evaluate all clauses simultaneously.

- **(13004, 01/13)**
  - REPORTED BY: Bettis
  - DESCRIPTION: A user reported that the system ordering is determined by the lowest numbered volume in a case. The second system is then

determined by the lowest numbered volume not in the first system. If on restart, a volume is added which has the lowest component number, the systems would be reordered.
    - STATUS: RESOLVED (NAA) Added a warning message in subroutine IMLP to print if the systems are reordered. Also added a paragraph in Vol. 2 of the manual to warn that adding volumes on restart should be done with care. Found that level stacks could be reordered on restart as well, and added a warning message and a paragraph in the manual.

- **(13005, 01/13)**
    - REPORTED BY: Bettis
    - DESCRIPTION: An error occurred in subroutine ISTATE at the conditions set in a volume using type 8. The conditions in British units are:
      P = 14.8 lb_f/in^2, T_f = 427 F, T_g = 427 F, voidg = 1.0, qualn = 0.0
      The code runs properly with version 2.4, but version 2.9.3 does not. Modifying T_f by moving at or below saturation made no difference. The user also tried using h2o and h2on. The problem in subroutine ISTATE is related to logical variable 'calcflag'. Once it is set to true, it is never reset to false for later volumes. The user sent updates for the errors.
    - STATUS: RESOLVED (NAA) Verified the failure point in subroutine ISTATE, and added the Bettis updates to correct the issue.

- **(13006, 01/13)**
    - REPORTED BY: Nolan Anderson, INL
    - DESCRIPTION: A continuation of the problem addressed in UP#08047. The deck used to correct UP#08047 which was a 4 theta volume problem with 1 level, and 1 ring was modified to have 2 rings. The flow diverged from symmetry after ~25 s.
    - STATUS: RESOLVED (NAA) Looked at the problem with George Mesina, and observed some potential issues with the way the solution matrix was set up. Found that the initial observed differences are due to round-off error in some calculations. Differences were first found in the calculation of variables 'coefm' and 'sourcem' in subroutine PRESEJ. These variables are summed over a do-loop, and because they are added in different orders for symmetric volumes, small differences occur. Modified subroutine PRESEJ by adding the 'coefm' and 'sourcem' variables with temporary variables which are sized to real*16, the values are then transferred back to the 'coefm' and 'sourcem' variables at the end of subroutine PRESEJ. This eliminated the observed differences in PRESEJ. Next found that the values obtained by the BPLU solver were also slightly different for symmetric volumes due to order of operations. Used a similar procedure, using real*16 variables inside the BPLU solver. The BPLU solver differences went away. Also found that some variables in subroutine EQFINL were slightly different due to order of operations. Used real*16 variables in EQFINL similarly to eliminate differences.

After making these changes, the results are now symmetric, for the entire transient problem. This also fixed the differences in various non-symmetric 3D problems. There is some considerable affect on computation time with these changes, so I am not planning on making this part of the default code. As a test ran the typ12002.i problem and these changes caused an increase in run time by 40%. An AP600 deck saw an increase in run time of 612%. Added copies of the BPLU routines and EQFINL and PRESEJ that could be accessed with card 1 option 63. When using this option, many 3D semi-implicit problems become symmetric.

- **(13008, 02/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The code fails w/ an unintentional core dump when the restart record time or advancement number requested in the restart input deck does not occur on the restart file. The code does give an error message, but then continues until it references non-existent data. In the problem I used, l2-5-emA.i, it failed in subroutine IREQUEST. It is suggested that the restart record error should stop at the message and not continue the input process just as missing restart file error does.
  - STATUS: RESOLVED (GLM) The coding was updated to fail if a non-available restart record is requested.

- **(13010, 02/13)**
  - REPORTED BY: George Mesina for Bettis
  - DESCRIPTION: When the plot file reaches just over 4 GB, the plot header becomes corrupt. This happens for XDR plot files only. ASCII and machine dependent binary plot files have no upper limit.
  - STATUS: RESOLVED (NAA,GLM, Ken Jones) Working with Ken Jones to resolve the limitation. Ken Jones provided corrections for this issue. The plot file now has no size limitations.

- **(13011, 02/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The number of reductions due to Courant limit differs between the base case and restart by one. This is true on the first step of restart for input deck eccmix.i
  - STATUS: RESOLVED (NAA) Found that at the point of restart, the time-step was being adjusted, so different time-step sizes were used for the base and restart cases. Added variable 'dtadj' to the restart file in module IDTMOD, which required the creation of read and write routines in IDTMOD. Also modified subroutine DTSTEP to not reset variable 'dtadj' for the first time-step of a restart.

- **(13012, 02/13)**
  - REPORTED BY: George Mesina, INL

- DESCRIPTION: On major edit @ 5.0 sec, base case and restart have different values for mass ratio. The restart prints ‘m.ratn’, base cast prints ‘m.rato’. Mass residual differs also @ 7.5 and 10.0 sec, as do ‘m.rato’, both print ‘m.rato’ after 1st major edit.
- STATUS: RESOLVED (NAA) Correcting UP#13011 also corrected this user problem.

- **(13013, 02/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Verification files differ between base case and restart from 1st advancement onwards in Uf, Ug, Vf, Vg, Voidf, tmep, cntrl and others. Differences diminish by end of transient.
  - STATUS: RESOLVED (NAA) Found that there were a few reflood variables that were not saved in the restart file, which caused the differences. Added variables 'zbunht', 'zqbot' and 'zqtop' to read and write routines in module RFMOD. The verification files now match.

- **(13014, 02/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Verification file base case and restart are THE SAME on 1st two dumps immediately after restart but are entirely different on final step. Number of advancements ~400 less on restart. This probably indicates the need for some quantity that is currently not written to the restart file to be written.
  - STATUS: RESOLVED (NAA) Correcting other similar user problems also corrected the issues observed with this user problem.

- **(13015, 02/13)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: The prop.i file tests h2o properties for subcooled liquid while crossing the critical pressure. The input file uses Option 11. The liquid temperature was 530 K and the fluid pressure varied between 22.0 and 23.5 MPa over a 10 second interval. Discontinuities were noted in the thermal conductivity on the first time step and at 0.7 s, when the pressure crossed the critical value. This problem worked correctly in Version 302t. The discontinuities were introduced in Version 350t. The root cause of the problem is that the transport properties are being calculated from interpolation of the tpf files rather than from subroutines THCOND and VISCOS for subcritical pressures. The transport properties are supposed to be calculated by interpolation of the tpf files only when Option 46 is used. This problem was originally observed with Option 11 because of the discontinuities, but also exists when Option 11 is not used.
  - STATUS: RESOLVED (CBD) An if test in subroutine STATEP was removed so that the two routines could be called regardless of the status of variable ‘trnsprt_set’.

- **(13016, 03/13)**
  - REPORTED BY: George Mesina for NuScale
  - DESCRIPTION: Issue with Simultaneous IF clause evaluation on multi-core processors. It is a generic problem in RELAP5-3D (and other codes) that the left-clause of an if-test is assumed to run before the next clause to the right. Therefore, out-of-bounds index checking is done in a clause to the left of one that uses the index. On multi-core processors, both clauses can be tested simultaneously according to the Fortran 90 standard.
  - STATUS: RESOLVED (NAA,GLM,HF) The entire relap directory was inspected, and a number of possible offending lines of code were changed to avoid this problem.

- **(13017, 03/13)**
  - REPORTED BY: Nolan Anderson, INL
  - DESCRIPTION: Found an issue with the 'delay' control variable that occurred when variable 'timehy' was approximately equal to another variable / calculation. At times it was slightly greater than the value, and other times it was slightly less than the value. These differences caused inconsistency in the calculation of the 'delay' control variable.
  - STATUS: RESOLVED (NAA) Modified the calculation of the control variable so that when the difference between variable 'timehy' and the test variable is greater than -1.0e-14 the if-tests in question are entered. This resolved the inconsistency.

- **(13019, 04/13)**
  - REPORTED BY: George Mesina for Bettis
  - DESCRIPTION: Plot files use integer*8 and real*8 data, so they are twice as large as necessary. Solution will need two parts:
    - Make default 4-byte, but allow 8-byte selection through input or command line;
    - Coding to switch from 4-byte to 8-byte if logical variable is set
  - STATUS: RESOLVED (GLM,HF,Jones) This took combined efforts from three developers:
    (1) Ken Jones modified the PIB library to allow 4-byte reals.
    (2) Hope Forsmann implemented the usage of the 4-byte floating point capability in plotmod.
    (3) George Mesina implemented the new 103/104 card keyword XDR4 and other changes to use it.
    The changes were made in 4.1.1t and go into 4.1.2t.

- **(13020, 04/13)**
  - REPORTED BY: George Mesina for Ansaldo Nucleare
  - DESCRIPTION: ANSALDO V&V'd software cannot read the machine-dependent binary plot file because the *plotinf* record has characters rather than integers. There may be other plot changes.

- STATUS: RESOLVED (GLM) Modified unformatted write statement for *plotinf* to use integers rather than characters for the two quantities in question. Through an iterative process with ANSALDO, we have determined just what format their software needs and have produced it in machine-dependent format, resulting in a series of updates to the plot and strip-file coding that implements this. The final form was tested by ANSALDO and deemed usable.

- **(13023, 04/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Deck reflecht.i1 from the verification restart test suite fails with a core dump. The traceback shows it occurs at IREQUEST line 1689, the call to reflood processing.
  - STATUS: RESOLVED (NAA) Found that the failure in subroutine IREQUEST was due to the fact that the reflecht.i1 deck used a non-existent restart number. Added an if-test in subroutine IREQUEST to avoid the error. The problem now fails gracefully. When correcting the restart number, the problem runs correctly.

- **(13024, 04/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Deck refbunm.i1 differs from refbunm.i0 in the verification file on the first step of restart for sums Uf, Ug, VOIDf, and the temperatures only. Further, the number of steps for the transient differs by 10.
  - STATUS: RESOLVED (NAA) The error was due to a bad input deck for the restart case. Corrected the deck and the differences were resolved.

- **(13025, 04/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Deck slab3.i0 produces a verification file that differs with the verification file of slab3.i1, its restart, only in the Errors-sums. This difference occus on all verification dumps (1st & 2nd after restart and final time-step).
  - STATUS: RESOLVED (NAA) Found that the restart input file had a 120 series card on it. This is not allowed for restart problems. After removing the 120 card, the differences were resolved.

- **(13027, 04/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Deck fwhtr.i1 reads to the end of the restart file without finding the record (Adv. 5000 @ 500.0) that is marked as being written by fwhtr.i0. Probable cause is in cmpmod.
  - STATUS: RESOLVED (NAA) Modified the read section of module CMPMOD to match the restart write section, and now the problem runs and there are no differences in the verification file.

- **(13032, 04/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Restart of rtsampnm.i1 fails on call to rtrnElim in rtrnmod.F (line 256).
  - STATUS: RESOLVED (NAA) Found errors in the read and write routines for the radionuclide data in module RTRNMOD. Corrected these errors which corrected the failures. The verification files were found to match, this problem is resolved.

- **(13033, 04/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Restart of rtsamppm.i1 fails on call to rtrnElim in rtrnmod.F (line 256).
  - STATUS: IN-WORK (NAA) Correcting UP#13032 also corrected this error.

- **(13034, 04/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: ANSALDO V&V'd software cannot read the machine-dependent binary plot file and strip file because the format does not match plot records as produced by RELAP5-3D/Version 2.4.2. Besides changes in UP 13020, they need records of pure blanks after the plotinf, plotalf, and plotnum records.
    Further, the machine DEpendent binary strip files need to have the same format for use by their software.
  - STATUS: RESOLVED (GLM) This UP and UP#13020 are related and solved through the same series of iterative improvements. See UP#13020.

- **(13035, 04/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: A different number of advancements occur for the ans.i0 and ans.i1 input decks. Restart of problem from 100.0 seconds does not use the time-step on the "1000.0 second" card, but rather the one from the "100.0 second" card. Seems to indicate a glitch in dtstep restart time-card processing. A user workaround is to restart in the middle of a time-interval.
  - STATUS: RESOLVED (GLM,NAA) Coding was corrected in subroutines DTSTEP and RTSC to account for the changing input cards. This resolved the error, and there are no longer any differences in the verification file.

- **(13039, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: RELAP5-3D/4.1.1 fails on case 8, horizontal annular mist, of problem floreg due to memory corruptions (glibc) at line 741 of

plotmod.f. This error cannot be killed with a control-C interrupt and must be stopped with kill -9.
    - STATUS: RESOLVED (GLM) With recent updates protecting allocate/deallocate statements, the restart problem now runs to completion.

- **(13040, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: RELAP5-3D/4.1.1 fails on case 6, heatmodes 10, 11, 12, of problem httest due to glibc memory corruption at line 741 of plotmod.f. This error hangs the terminal such that it cannot be terminated with control-C and the process must be destroyed with kill -9.
    - STATUS: RESOLVED (GLM) Removing all references to variable listElement in plotmod.F fixed the memory leak caused by allocating without commensurate deallocates; the variable was no longerused in calls to the PIB library or anywhere else. The changes were made in 4.1.2 and will go into 4.1.3.

- **(13041, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: RELAP5-3D/4.1.1 fails on case 11, light water with high-temperature vapor, of problem state due to glibc memory corruption at line 741 of plotmod.f. This error hangs the terminal such that it cannot be terminated with control-C and the process must be destroyed with kill -9.
    - STATUS: RESOLVED (GLM) The memory leak that cause the glibc error was traced to variable listELement which was unconditionally allocated in three places but not deallocated. Since it was no longer in use in calls to the PIB library (or anywhere else) it was eliminated completely from plotmod. In addition, there were errors in the restart input deck state.r.i that were corrected. The corrections were made in 4.1.2 and will go into 4.1.3.

- **(13042, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: All four cases of the boronm.i deck problem differ from boronm.r.i at both the initial verification dump and the final dump. Most of the L1-norm values differ and the solution array differs by orders of magnitude. Use of the 105 card shows that these solution values are indeed that different, O(1.0e-10) for restart vs. O(1.0e-12) for base case, so there is no summing error.
    - STATUS: RESOLVED (NAA) Found that the restart input deck repeated the initialization cards from the base case, which was the source of the differences. Also the MA18 and PGMRES solvers were used and will not restart properly. This will be submitted as a separate UP.

- **(13044, 06/13)**

- REPORTED BY: George Mesina, INL
- DESCRIPTION: The restart of cyl3 has a different sum of Errors than does the base case. All other values are the same at the first and final time step.
- STATUS: RESOLVED (NAA) Found that the restart input file had a 120 card in it, which causes differences and is not supposed to be entered on restart. Removing the 120 card fixed the errors.

- **(13045, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The base input deck runs 3 cases successfully. The restart runs core dumps on Case 2 in ihtcmp.f on line 63.
  - STATUS: RESOLVED (NAA) There were several problems with the restart input deck in Cases 2 and 3. The 120 and 110 cards were removed, the titles of Case 2 did not matched and were made the same, the 103 cards were corrected, and the 199 cards were adjusted to write the same dumps.

- **(13047, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The first case agrees perfectly between base and restart. The first and final step disagree on the second case. The L1-norms agree to 8 decimal places for Uf, Ug, Vf, Vg, and Temp. This suggests some 8 byte quantity becomes a 4-byte quantity through the restart process or as a result of restart initialization.
  - STATUS: RESOLVED (NAA) Found that subroutine IHTNCP re-initialized many variables on restart. The subroutine IHTNCP uses the alternate fluid coupling model, and it was not protected from a reinitialization on restart. Added an if-test to protect from reinitialization. This corrected the issue, and there are no longer differences in the verification file.

- **(13050, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The first time step verification dumps are identical between base and restart runs. On the final step, Uf and Ug differ in the last bit, but others have much greater differences.
  - STATUS: RESOLVED (NAA) This case no longer core-dumps, the error is resolved.

- **(13051, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The base deck runs, but the restart fails in line 46 of idetector.f.

    - STATUS: RESOLVED (NAA) Found that with the fixes that went into UP#13038 this problem now runs and there are no differences in the verification file.

- **(13052, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: The base deck runs to completion. The very simple restart file has no replacement cards, but complains that: Shaft component 10 references nonexistent pump, turbine, or generator component.
      The reference should not be able to disappear on restart.
    - STATUS: RESOLVED (NAA) Found that variable 'cnvr4()%scp' was only writing and reading the last variable in the array. Module CNVMOD was modified to read and write all of the values of the array. This corrected this issue.

- **(13055, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Many problems show slight differences in the last couple decimal places when backup is forced after every successful advancement. These differences ignore RHSth and SOLth which are unreliable when backing up every successful step.
    - STATUS: RESOLVED (NAA) Modified the backup coding so that a backup was not taken until after the first time-step, and so that a backup was not taken on a time step that had a natural backup. Found that variable 'hyarug' was calculated a little differently in subroutine MOVER. Modified the calculation so that it was the same as in other places in the code. With these modifications, there are no differences in the verification file when running these problems. This problem is resolved.

- **(13056, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Comparing Base and "backup after every successful step" runs at the final timestep shows:
      Uf, Vf, Vg, and Temp are good to about 7 significant digits
      Ug is good to 4 and Error is good to 2.
    - STATUS: RESOLVED (NAA) Found that the verification file testing logic was misplaced for heat structures. This caused the code to go into subroutine HTFINL an extra time, which caused differences in the heat structure temperature. The coding was moved, which corrected the issue.

- **(13058, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Comparing Base and "backup after every successful step" runs at the final timestep shows differences: for the edhtrkm.i input deck - Uf, Ug, VOIDf, Vf, Vg, Error, Temp, and Cntrl are good to about 3-6 significant digits. Trips and dtsum match perfectly.

    - STATUS: RESOLVED (NAA) With recent fixes to the backup logic, the differences in the verification file were nearly all eliminated. The only difference that is still seen is an extrapolation reduction on the first time-step. This difference is of little consequence, and this user problem is resolved.

- **(13059, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the eflag.i input deck at the final timestep shows differences in ALL calculated values: Uf, Ug, VOIDf, Vf, Vg, Error, and dtsum are good to 0 or 1 significant digits. The counts differ
    - STATUS: RESOLVED (NAA) With recent changes, the differences were completely eliminated.

- **(13060, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the enclss.i input deck at the final time step shows differences: Uf, Ug, Vf, Vg and Temp are good to 8-10 significant digits. Error is good to 2 dtsum matches perfectly.
    - STATUS: RESOLVED (NAA) With recent changes, the differences were completely eliminated.

- **(13061, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the fwhtr.i input deck at the final time step shows differences: Uf, Ug, VOIDf, Vf, Vg, Error, Temp and Cntrl are good to 4-6 significant digits. dtsum matches perfectly.
    - STATUS: RESOLVED (NAA) With recent changes, the differences were completely eliminated.

- **(13062, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the gota27.i input deck at the final time step shows differences: Uf and Ug are good to all but last bit. Vf, Vg, and Error are good to 5-7 digits. Temp is good to 8. VOIDf and dtsum match perfectly.
    - STATUS: RESOLVED (NAA) With recent changes, the differences were completely eliminated.

- **(13063, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Comparing Base and "backup after every successful step" runs at the final time step shows differences: Uf are good to all but

last bit. Ug is good to about 10 significant digits. Ug is good to about 9 significant digits. Vf, Vg, and Error to 4-6 places VOIDf and dtsum match perfectly.
    - STATUS: RESOLVED (NAA) With recent changes, the differences were completely eliminated.

- **(13065, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the hxco2m.i input deck at the final time step shows differences: VOIDf and dtsum match perfectly. All other calculated are good to only 1-3 places.
    - STATUS: RESOLVED (NAA) With recent changes, the differences were completely eliminated.

- **(13066, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the jetjun.i input deck at the final time step shows differences: Uf, Ug, VOIDf, Vf, Vg, Error, and are good to 7-9 significant digits. Trips and dtsum match perfectly.
    - STATUS: RESOLVED (NAA) With recent changes, the differences in the verification file were nearly eliminated. There is a single reduction in time-steps that is of little consequence, this problem is resolved.

- **(13068, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the pitch.i input deck at the final time step shows differences: Uf, Ug, and dtsum match perfectly. Vf, Vg, are good to all but last bit. Error is only good to about 2 places.
    - STATUS: RESOLVED (NAA) With recent changes, the differences in the verification file were eliminated.

- **(13069, 06/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the pitch.i input deck at the final time step shows differences: Uf, Ug, and dtsum match perfectly. Vf, Vg, are good to all but last bit. Error is only good to about 2 places.
    - STATUS: RESOLVED (NAA) With recent changes, the differences in the verification file were eliminated.

- **(13073, 06/13)**
    - REPORTED BY: George Mesina, INL

- DESCRIPTION: Comparing Base and "backup after every successful step" runs for the slab3.i input deck at the final time step shows differences: Uf and Cntrl are good to about 10 places. Ug, Vf, Vg, and are good to about 4 significant digits. Error is good to 2. VOIDf and dtsum match perfectly.
- STATUS: RESOLVED (NAA) With recent changes, the differences in the verification file were eliminated.

- **(13074, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the sphere3.i input deck at the final time step shows differences: Uf and Cntrl are good to 9 places Ug, Vf, Vg are good to about 5 significant digits. Error is only good to 2 places VOIDf and dtsum match perfectly.
  - STATUS: RESOLVED (NAA) With recent changes, the differences in the verification file were eliminated.

- **(13075, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the todcnd.i input deck at the final time step shows differences: Uf, Ug, Vf,and Temp are good to 9-10 places Vg is good to about 7 significant digits. Error is good to 6 places dtsum matches perfectly.
  - STATUS: RESOLVED (NAA) With recent changes, the differences in the verification file were eliminated.

- **(13080, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The backup rcpr.i input deck fails in Case 1 of 1 (both base and restart decks run the cases at plotmod.f line 797. The following message is: *** glibc detected** * ../../../relap/relap5.x: corrupted double-linked list: 0xb7e15938 *****
  - STATUS: RESOLVED (GLM) Modified plotmod.F to eliminate derived type variable "listElement" and protected all its deallocate statements. Placed if-test protection on half of the deallocate statements of the rest of the code. This solved the problem. The update is named azb413b.

- **(13081, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The backup floreg.bk.i input deck fails in Case 10 of 22 (both base and restart decks run all cases) at plotmod.f line 797. The following message is: *** glibc detected** * ../../../relap/relap5.x: corrupted double-linked list: 0xb7e15938 *****

- STATUS: RESOLVED (GLM) The fix for UP#13080 also fixed this error.

- **(13082, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: THIS ERROR is INTERMITTENT. If occurs when eflag.i is called after edhtrkm by the Makefile but not when run by itself. The restart input deck fails in Case 2 of 2 at plotmod.f line 797. The following message is: *** glibc detected** * ../../../relap/relap5.x: malloc(): memory corruption: 0x00002adda92e0010 *****
  - STATUS: RESOLVED (GLM) Found that the restart input deck had errors in it and fixed them.

- **(13084, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The restart input httable.r.i deck fails in Case 2 of 3 at plotmod.f line 797. The following message is: *** glibc detected** * ../../../relap/relap5.x: malloc(): memory corruption: 0x00002adaca6ab010 *****
  - STATUS: RESOLVED (NAA) With recent updates, the case now runs to completion, but there are a number of differences in the verification file. The restart input deck required some modification. With these changes the differences between the verification files was eliminated. This problem is resolved.

- **(13089, 08/13)**
  - REPORTED BY: Alessandro Del Nevo, ENEA
  - DESCRIPTION: A user reported that the strip file format changed slightly between versions. Specifically that a blank line was added to the strip file. This caused issues with the user's post processing tools.
  - STATUS: RESOLVED (GLM) The extra space was removed in plotmod. The coding is included in 4.1.3.

- **(13091, 08/13)**
  - REPORTED BY: Dmitry Afremov, NIKIET
  - DESCRIPTION: User contacted Nolan via email to report that he could not write a strip file with the XDR format using the 100 card to specify the format.
  - STATUS: RESOLVED (GLM) This is primarily a documentation problem. The coding is modified to further solve the problem. Volume 2, Appendix A, Card 104 states that the strip file cannot be written in XDR format. This decision was made based on the Ken Jones XDR software not providing a means to open two different XDR files simultaneously and the realization that anyone wanting an XDR strip file would almost certainly be stripping an XDR plot file. Volume 2, Appendix A, Card 100 will be modified to state that strip files may not be

written in the XDR format. The coding in subroutine INPUTD has been modified to print a message to the user when XDR strip format is requested, warning that the code is resetting the format to FMTOUT. The code sets variable IS2 to 5 and this is incorporated into variable IROUTE. The code update, azb413k, is being submitted to version 4.1.3.

- **(13092, 08/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Case two of 2ppmpmod.i does not restart. It fails in cmpmod.f at line 2644, the read of variables len and iwrd in the two-phase pump section of the component module restart read subroutine, cmpRead. This problem was found due to the verification project.
  - STATUS: RESOLVED (GLM) There were two problems. The first problem was that the inquire statement accessed only the final value of each array, thus creating a length value of 1 which was written on the restart file as the array length. This in turn caused the read statment to be skipped because the variable alleng did not equal the product of len and iwrd. This caused the read after xval's read to read two integers from a data record with a single real value to produce a core dump. The second problem was revealed dueing the solution of the first. The write and read statements for xval, yval, and zval accessed only the final value in each array, leaving the rest of the array undefined on restart. This resulted in the code failing with an error message. The solution for the first problem was to comment out the inquire and if-statments to checked array length for xval, yval, and zval. The second was to remove the reference to lenx and leny from the read and write statements, allowing the FORTRAN compiler to control data placement for the read and write.

- **(13093, 08/13)**
  - REPORTED BY: John Marking, mPower
  - DESCRIPTION: An external user reported that when a minimum value was used with a proportional-integral control variable, the results of the control variable were distinctly different than when the minimum value was not input.
  - STATUS: RESOLVED (NAA) Found that the contribution of the integral term of the proportional integral control variable used the minimum and maximum values that are user input. The min and max should only be applied to the final value of the control variable instead of just a part of the calculation. Modified the calculation so that the min and max are only applied to the final value of the control variable, and now the final values are the same whether or not a min/max is applied.

Highest Priority User-Reported Problems Being Worked as Time Permits

- **(00081, 11/00)**

- DESCRIPTION: In using the metal-water reaction, cladding deformation, and gap conductance models on all code versions, it was found that the only available minor edit/plot variable is the volume flow area. It is requested that variables associated with these models (i.e., oxide thickness, cladding stress, etc.) be made available.
- STATUS: IN-WORK. The following list was created, based on the user's list: oxide thickness, power from oxidation, total hydrogen mass generated, outer radius, plastic hoop strain, cladding hoop stress, and cladding axial stress. The oxide thickness on the inside of the cladding and the oxide thickness on the outside of the cladding were added to the code as a result of resolving UP#03060; these appeared in version 2.3.1. The other requested variables still need to be added. Power from oxidation was added when version 3.5.0 was released. The remaining variables are outer radius, plastic hoop strain, cladding hoop stress, and cladding axial stress.

- **(02065, 9/02)**
  - DESCRIPTION: Examination of the thermal non-equilibrium model indicates that the code appears to not satisfy Onsager's reciprocity relation and thus appears to be not in accordance with the principles of irreversible thermodynamics. This is for the case without wall heat transfer and for the case with wall heat transfer.
  - STATUS: IN-WORK. Emailed the user a short description of Appendix B from a draft paper at INEEL that was never published; it is titled Anomalous Numerical Behavior in Two-Phase Flow Simulations. They agreed that this appendix might address the issue. The full draft paper was then sent.

    The user had made the code changes discussed in his 2002 RELAP5 International Users Seminar paper, and then he ran a vertical fill problem. The code changes use saturation phasic enthalpies in the interface mass and heat transfer models. The user's calculation shows superheated vapor (physically incorrect) when subcooled liquid enters the volume from below. The user said the entropy was fine (no violation of the 2nd law). He is now looking at his coding changes to find the cause of the problem. INEEL suggested that he also run the Bankoff horizontal condensation test.

    The user called to update INEEL on his progress. He is running the Bankoff horizontal pipe condensation problem and the vertical pipe fill problem with his updates (uses the saturation phasic enthalpies in the interface mass and heat transfer models). He is modifying the interfacial heat transfer coefficients (Hif and Hig) as suggested in the above mentioned draft paper (Appendix B). He plans to present his results at the 2003 RELAP5 International Users Seminar in August in West Yellowstone.

    The Bankoff horizontal pipe condensation problem results (with a modified Hig interfacial heat transfer coefficient) were presented at the 2003 RELAP5 International Users Seminar in August in West

Yellowstone. One of the attendees indicated that one of the TRAC-P manuals discussed the enthalpies at the interface in some detail. Copies of items discussed will be sent to the user and to INEEL. The latest Bankoff input decks were also sent to the user.
Came across a journal article in the October 2004 issue of the Journal of Fluid Mechanics that is related to the user's work. The article is on two-phase modeling using the theory of irreversible processes and is by Miltiadis Papalexandris of Belgium. The information was emailed to the user.
The user published his work in the Journal of Nuclear Engineering and Design in 2005.

- **(04021, 4/04)**
  - DESCRIPTION: In running the AP600 input deck (ap3dsbs.i) on version 2.3.2+updates, using BPLU and the nearly-implicit scheme, the calculation fails in subroutine BPPART. The error message read: "chain connects to a previous chain, Error: chain, member, neighbor = 11 2833 2601". The same deck runs with BPLU and the semi-implicit scheme.
  - STATUS: IN-WORK (GLM,NAA) In the FORTRAN 95 version 2.9.4, BPLU now has its own arrays. In running the input deck on version 2.9.4, the calculation fails in subroutine TSETSL with a segmentation fault on a call to BPLU subroutine BPARAM. Found that some of George's updates to bparam.F and bppart.F were not in the coding. After this correction it was found that arrays in slot3dmod.F were not allocated large enough. The allocation size of the arrays was increased. The problem now runs past input processing but fails with a thermodynamic property error.

- **(05013, Low, 03/05)**
  - REPORTED BY: Bettis
  - DESCRIPTION: There is a need to allow the user the option to input the choking models' discharge coefficients and thermal nonequilibrium constant for various hydrodynamic components. This was found in RELAP5-3D version 2.4.1; this affects all earlier and all later RELAP5-3D versions.
  - STATUS: IN-WORK (RAR) Bettis provided an update to do this to subroutine RPIPE for the pipe/annulus/pressurizer hydrodynamic components for version 2.4.1. Began putting this update into my version 2.4.1.

- **(06015, Low, 2/06)**
  - REPORTED BY: Bettis
  - DESCRIPTION: This is the generic problem discussed in UP#06012, where the thermodynamic interpolator subroutines need to be changed to remove the practice of setting 'variable1' equal to '1.0/variable2' and then using 'variable1' more than 1 time in the coding. This was found in RELAP5-3D version 2.1.4; this affects all earlier and all later RELAP5-

3D versions.
    - STATUS: IN-WORK (RAR) Began work on the h2o interpolators in directory 'envrl' in version 2.1.5. Modified subroutine STH2X6 to remove the use of this practice for the variables 'f1', 'hfg1', 'r2', 'c0'. Examined subroutine STH2X0; no changes are needed. Currently working on subroutine STH2X1. Work continued on the h2o interpolators in directory 'envrl' in version 2.1.5. Modified subroutine STH2X1 (removed this practice for variables 'f1', 'hfg1'). Examined subroutine STH2X3; no changes are needed. Modified subroutine STH2X4 (removed this practice for variables 'r1', 'r2'). Currently working on subroutine STH2X5 [removed this practice for the variables 'hfg1', 'r2', and 'co' (in some places)]. Worked on subroutine PSATPD (removed this practice for the variable dt). This completes the h2o interpolators. Worked on the h2on interpolators (removed use of the variable 'prat' in subroutine STPUOO). Continued working on the h2on interpolators [removed use of the variables 'fxl', fxl2', 'fxl3', and 'prat' (in some places) in subroutines STPUOP and STPU2P]; [removed use of the variable 'urat' (in some places) in subroutine STPU2P]; [removed use of the variables 'fyl', 'prat', and 'fyl2' (in some places) in subroutine STPU2P]; [removed use of the variables 'fyl2' and 'fyl3' (in some places) in subroutine STPU2P]; [removed use of the variables 'fyl3' and 'prat' (in some places) in subroutine STPU2P]; [removed use of the variables 'fxl' (in some places) and 'fxl2' (in some places) in subroutine STPU2PU].

- **(06058, Medium, 10/06)**
    - REPORTED BY: Bettis
    - DESCRIPTION: In running a system calculation using the 3D hydro multid component, nonphysical results were observed in the 3D component near the 1D-3D connection. This was found in RELAP5-3D version 2.4.1; this affects all earlier and all later RELAP5-3D versions.
    - STATUS: IN-WORK (RAR) Talked to Bettis about the problem. They said the modified LeVeque flux splitting card 1 options 93/94 were on for the calculation. He is putting together a representative input deck that demonstrates the problem.

- **(06065, Low, 11/06)**
    - REPORTED BY: Walt Weaver, INL
    - DESCRIPTION: The vapor density in the modified Bromley correlation is computed using the bulk vapor temperature instead of the film temperature. The manual is correct, but the code is not. This was found in RELAP5-3D version 2.5.8; this affects all earlier and all later RELAP5-3D versions.
    - STATUS: IN-WORK (RAR) Continuing to examine the problem.

- **(07006, Low, 1/07)**
    - REPORTED BY: Cliff Davis, INL

- DESCRIPTION: The implicit heat transfer coupling option (ssdtt = 7) in version 257 causes large errors in energy conservation and extreme time-step sensitivity for a near adiabatic heatup of a non-flowing sodium system. The erroneous behavior depends on the heat transfer coefficient and is large for sodium, significant for Pb/Bi, and small for water. The results with the explicit option are in good agreement with theory and show no time-step dependence. This was found in RELAP5-3D version 2.5.7; this affects all earlier and all later RELAP5-3D versions.
- STATUS: IN-WORK (RAR) Put together copies of Dick Wagner's implicit hydro-heat transfer coupling derivation and marked up subroutines where this occurs in the semi-implicit hydro scheme for Cliff. Got the input deck (4 cases) from Cliff; tested it on version 2.4.1; got the same results as Cliff. Walt Weaver and I discussed the problem with Cliff along with the analysis/debugging he has done. Examined the coding; did some hand calculations. The original input deck used cylindrical geometry with the volume on the right side; modified the heat structure input to use rectangular geometry on the left side and also on the right side. Verified the same problem occurs on either side, which Cliff had previously found.

- **(07046, 11/07)**
  - REPORTED BY: Jonathan Downing, Rolls-Royce, UK and Rob Roth, Electric Boat
  - DESCRIPTION: Rolls-Royce (UK) has recently installed a noncondensable gas solubility model into a modified version of RELAP5/MOD2. The model allows dissolved noncondensable gas to exist in the liquid phase. The noncondensable gas solubility model should be put into RELAP5-3D. This improvement is not in any of the RELAP5-3D versions.
  - STATUS: IN-WORK (RAR) Based on a statement of work from Bettis, prepared a proposal with estimates (to be sent to Bettis) to put the model into the latest RELAP5-3D version. Cliff Davis reviewed the proposal; incorporated Cliff's comments. Sent the revised proposal to Phil Sharpe, Jim Wolf, and Paul Bayless for their comments. Phil Sharpe, Jim Wolf, and I discussed their comments on the dissolved noncondensable proposal; changes were made to the proposal. Phil sent the proposal to Bettis. Glenn Roth is currently working on his Ph.D. through University Place and is planning to have this improvement for RELAP5-3D be his thesis project]. Walt Weaver (consultant) would be on Glenn's committee, and Cliff Davis and I would also be available for assisting Glenn. Reviewed Glenn's 2 page summary that University Place needed; also gave Glenn some references that I ran across for dissolved noncondensable gas modeling by people doing studies on dams and spillways. Came across a recent paper in the journal Annals of Nuclear Energy on the noncondensable model in the APROS code (Finland); the model includes dissolved noncondensable gas in liquid. Emailed the paper to Glenn Roth.

Phil Sharpe, Jim Wolf, and I discussed revisions needed in the dissolved noncondensable proposal; made the changes to the proposal. Sent the proposal to Jim; Jim is currently revising it, and he will then send it to Phil.

- **(07048, High, 12/07)**
  - REPORTED BY: Bettis
  - DESCRIPTION: In running a PVM heat structure coupled problem on version 2.1.4, the code ran fine. When running the same problem on version 2.4.1, the code failed. Examination of the coding between version 2.1.4 and 2.4.1 showed large coding differences (e.g., subroutine HTCOND). This was found in RELAP5-3D version 2.4.1; this affects perhaps some earlier and perhaps all later RELAP5-3D versions.
  - STATUS: IN-WORK (RAR) Bettis had sent the problem that has the failure. Discussed the problem with Bettis. They suggested the following tests which were tested: tested the problem on version 2.1.5 (is same as version 2.1.4 except for RGUI changes) that is installed without PVM and tested the problem on version 2.1.4 that is installed with PVM; both fail with a negative wall temperature in the thermal conductivity table. Also, tested the problem on version 2.8.6 that is installed without PVM; also fails with a negative wall temperature in the thermal conductivity table. Passed this info on to Bettis.

- **(08027, Low, 8/08)**
  - REPORTED BY: Walt Weaver, Studsvik
  - DESCRIPTION: Errors exist in subroutine RR5PVMC in the pvm kinetics coupling sections for both send and receive messages. The coding that expands the starting and ending volumes when specifying a range of hydro component volumes is incorrect (coding is in a loop from 1 to nrepeat; volume number is computed based on hydro component type). First, a multiple junction hydro component cannot be named in input, only components with volumes. Second, the multi-dimension hydro component coding incrementation is wrong. This was found in RELAP5-3D version 2.8.0; this affects all earlier and all later RELAP5-3D versions.

- **(08038, Low, 10/08)**
  - REPORTED BY: Bettis
  - DESCRIPTION: In running a system calculation, two problems were found.
    a) In subroutine PSTDNB, it was found that the variables ‘betas’, ‘cps’ and ‘kapas’ were not defined for noncondensable quality > 1.0E-9. Bettis provided the update.
    b) In subroutine RAPPK and PSTDNB along with the input manual, there are problems with the Appendix K option trips (default values and variable/logical). This was found in RELAP5-3D version 2.6.2; this affects some earlier and all later RELAP5-3D versions.

- STATUS: IN-WORK (RAR) (a) Traced the error to version 2.0.2 (April 2002), when the improved viscosity and thermal conductivity (1967 ASME tables, 4th edition) went into the code. Added the update to version 2.8.3. The update was submitted and will appear in version 2.8.4. Discussed this with Bettis. Currently reviewing the code and input manual.

- **(09001, Low, 1/09)**
  - REPORTED BY: Bettis
  - DESCRIPTION: In reading the Appendix K coding, the coding for the ANS 1971 decay heat does not follow the normal coding standards. In addition the Appendix K coding in the whole code needs to be cleaned up to remove unnecessary comments, commented out Card 1 options, etc. This was found in RELAP5-3D version 2.6.2; this affects all earlier and all later RELAP5-3D versions.

- **(09003, Low, 1/09)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: The semi and nearly implicit schemes do not give the same pressure gradient for a pure radial, symmetric flow problem with the multid component when the modified LeVeque flux splitting (option 93-semi, option 94-nearly) is applied. The semi and nearly schemes give the same results at 10s when options 93 and 94 are not used. The nearly implicit scheme with option 94 on gives the same results as the semi scheme with option 98 (upwind differencing) on. With upwind differencing (donoring) (option 98) on, the nearly gives the same results as the semi with default options. Options 94 and 98 are not implemented correctly in the nearly. This was found in RELAP5-3D version 2.6.2; this affects some earlier and all later RELAP5-3D versions.
  - STATUS: IN-WORK (RAR) Discussed the problem with Cliff. We looked at previous verification test reports when options 93 and 94 were tested by the developers; these reports do not match Cliff's results. I ran both the semi-implicit scheme and nearly-implicit scheme DA decks (use options 93 and 94) on version 2.8.6; found the same results Cliff found on version 2.6.2.
    Examined the semi-implicit scheme. Cliff found that the base code gave the correct results for the pure radial symmetric flow test; he found that the base code was using the modified Leveque because this coding incorrectly came on when option 93 was not set; it should have come on when option 93 was set. Traced the error to 1998 when Art Shieh put in the modified Leveque in the semi-implicit scheme subroutine FLUX3D (used the variable 's1d3d'); this error has remained until the current code. Around the same time (1998), Art had incorrectly read the coding and asked me to modify subroutine RCHNG to indicate option 93 was for the modified Leveque in the semi-implicit scheme.
    Cliff suggested we should keep the base code using the modified Leveque, and we should change subroutine RCHNG to say options 93 and 94 are for

pure Leveque. Cliff indicated we also need to change the nearly-implicit scheme subroutine COEV3D, since option 94 does not give pure Leveque for the nearly-implicit scheme as option 93 does for the semi-implicit scheme. Discussed this with Bettis; they agree with Cliff's approach. Currently examining subroutines RCHNG and COEV3D in order to make these changes.

- **(09008, 2/09)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: DA calculations for the MULTID component with the default nearly-implicit scheme showed that the nearly-implicit scheme did not agree with the exact solution for the radial pressure distribution for the rigid body rotation and R-θ symmetric problems (The semi-implicit scheme was in agreement with the exact solution). Debug printout for the R-θ symmetric problem showed that 'velfjo' and 'velfj' differed at "steady-state". This was found in RELAP5-3D version 2.8.6; this affects perhaps all earlier and all later RELAP5-3D versions.
  - STATUS: IN-WORK (RAR, GAR) Verified the rigid body rotation problem exists with the nearly-implicit scheme on versions bf08, 2.4.2, 2.6.2, and 2.9.1; began debugging this on version 2.9.1 by examining the major edits and the diagnostic edits on the first 6 time steps for both the semi-implicit and nearly-implicit schemes; noticed differences on the inner ring and particularly at the connection between sector 6 and sector 1. Cliff suggested putting the correct final pressures for the initial pressures on both the semi-implicit and nearly-implicit runs as is done for the velocities; did this and this helps in debugging. Added calls to subroutine HELPHD (writes diagnostic print page header) in subroutine COEV3D (in the x/r direction coding), COV3DY, and COV3DZ so one can tell if the print is from the x/r direction, the y/theta direction, or the z direction. Moved the update to subroutines FLUX3D, COEV3D, COV3DY, and COV3DZ (that modifies the diagnostic edits and adds more comments) from version 2.9.1 to version 2.9.2. The update was submitted and will appear in version 2.9.3. Continued debugging by putting writes in subroutines FLUX3D (semi) and COEV3D (nearly) and examining the printout/coding. Glen Roth is now working on this problem; currently working with Glenn to show him the problem and coding issues. Gave Glenn the updates to subroutines FLUX3D, COEV3D, COV3DY, and COV3DZ (that modifies the diagnostic edits and adds more comments) and the writes used for debugging. Working with Glenn on the problem.

- **(09010, 3/09)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: Energy balances on the accumulator in typpwr showed that the 'hgf' minor edit variable, the direct heating heat transfer coefficient, is not correct for accumulator components. 'hgf' is set to 10000, but an evaluation of the natural convection correlation and the

energy balance indicates that the actual value is much smaller (~20). The code calculations appear to be correct; just the value of the minor edit is wrong. This was found in RELAP5-3D version 2.4.2; this affects all earlier RELAP5-3D versions (as well as all RELAP5/MOD2 and RELAP5/MOD3 versions) and all later RELAP5-3D versions.
    - STATUS: IN-WORK (RAR) Looked in the coding; the variable 'hgf' needs to be set in subroutine STACC; other variables such as 'hif', 'hig', 'sathf', 'sathg', etc. also need to be set in subroutine STACC. Per Cliff's advice (until the code is updated so that these variables are calculated in subroutine STACC), modified my copy of the input manual (Volume II, Appendix A) to indicate these variables are not set for an accumulator. Next, the coding needs to be changed to calculate the variables 'hgf', 'hif', 'hig', 'sathf', 'sathg', etc. in subroutine STACC.

- **(09017, 4/09)**
    - REPORTED BY: Peter Cebull, INL
    - DESCRIPTION: In the bubbling steam through liquid DA case, the nearly-implicit results show a large step increase in tmass-0 after 800 s, and the time step size goes way down. The mass error also goes way up at that point. The semi-implicit results do not show this behavior. This was found in RELAP5-3D version 2.6.2; this affects perhaps all earlier and all later RELAP5-3D versions.
    - STATUS: IN-WORK (RAR) Got the 2 input decks from Peter; verified the problem on version 2.9.2. Around 854 s, start getting many repeats without time step cuts (i.e., succes equal 5) for the nearly-implicit scheme. Around 953 s, start getting many repeats with time step cuts (i.e., succes equal 1 or 2) for the nearly-implicit scheme. Continuing to debug the problem on version 2.9.2.

- **(09020, 4/09)**
    - REPORTED BY: Cliff Davis (for Zen Wang of GSE)
    - DESCRIPTION: The two-stage GE separator problem does not run correctly on Version 241. The code predicts a carry under quality (mg/mf/J 550-02) of about 45 %. The GE data for this case (xi-500 = 0.0474) is about 0.2 % (see Figure 1 of R% M3DA-001). Version 2.1.0 works correctly. Zen also reports that the 241 results with the separator component replaced by a branch are close to the results with the GE separator model. The GE separator model appears to have been turned off in later codes. (Note that the variable xi-500 differs significantly from the flow quality at the inlet to the separator.) This was found in RELAP5-3D Version 2.4.1; this affects perhaps all earlier RELAP5-3D versions after version 2.1.0 and all later RELAP5-3D versions.

- **(09021, 5/09)**
    - REPORTED BY: Bettis
    - DESCRIPTION: In running a system calculation using the alternate heat

structure - fluid coupling model, some desired improvements to the model were noted. The current model modifies the vapor/gas temperature, but it does not address the vapor/gas density. The current model does not address the liquid temperature and liquid density. The current model addresses the heat structure - fluid coupling, but it does not address the reactor kinetics - fluid coupling. These improvements are not in RELAP5-3D version 2.4.1; these improvements are not in all earlier and are not in all later RELAP5-3D versions.

- STATUS: IN-WORK (RAR) Discussed the problem with Bettis. They indicated that they are currently modifying the coding to address these items in version 2.6.2. Bettis will then send the code changes and manual changes to INL for incorporation in the base RELAP5-3D code and manual. Bettis asked for the electronic Framemaker files of Walt Weaver's SDID and VTR in 2006 for this model, so that Bettis can modify the files to include these items. Found the files on the PC that Walt Weaver used; there were some errors in the SDID that were corrected in the VTR. Nolan Anderson modified the SDID to fix the errors, and then Nolan sent the modified SDID and the VTR to Bettis. Bettis is currently focusing on adding the liquid temperature. Emailed Bettis the 2 input decks in the run/Extra directory used to checkout the coupling (hxco2_10.i and hxco2_ncp10.i). Modified the input deck hxco2_ncp10.i to use 2 heat structure geometries that had the alternate heat structure - fluid coupling model (new deck is called hxco2_ncp210.i); tested it at INL; the writes seem to agree. Sent the input deck hxco2_ncp210.i to Bettis to test. Bettis said the update appears to working as intended; Bettis is currently doing more testing. Bettis had finished adding the liquid temperature, the update was working as intended, and that the testing is going as expected. Bettis found that the variable 'sumha' was used in a divide by zero in subroutine HTADV and IHTNCP; Bettis provided the fix to this by testing on 'sumha' equal to zero in an earlier 'if test'. The HTADV and IHTNCP updates were submitted and will appear in version 2.9.3. Finished reviewing the modified SDID/VTR that Bettis faxed to me, that adds the liquid temperature; emailed my comments back.

- **(09022, 5/09)**
  - REPORTED BY: Paul Bayless, INL
  - DESCRIPTION: When using the nearly-implicit solution scheme for the 3D r-theta symmetric flow problem, changing the orientation of the junctions external to the 3D component changes the results. This is not seen with the semi-implicit solution scheme. The pure radial symmetric flow problem works correctly with these model changes with both solution schemes. This was found in RELAP5-3D version 2.9.2; this affects perhaps all earlier RELAP5-3D versions, and it affects no later RELAP5-3D versions, since version 2.9.2 is the latest version.
  - STATUS: IN-WORK (RAR) Discussed the problem with Paul, and he showed me his plots. Turned on the major edits, diagnostic edits, and

writes every time step for 6 time steps; verified Paul's results. Currently examining the major edits, diagnostic edits, and writes on the 1st time step; working with Glenn Roth on the problem.

- **(09031, 6/09)**
  - REPORTED BY: Raymond Wang, INL
  - DESCRIPTION: In subroutines COEV3D and FLUX3D the logic variable 'dncext' exists to distinguish the usage of different velocity discretization equations. However, 'dncext' does not change from false to true throughout the nonspecific parts of each code. The only time it is true is in the downcomer specific section of the code, which does not point to any other part of the code. This problem was found in RELAP5-3D version 2.9.2; it affects all later RELAP5-3D versions since version bt.

- **(09033, 6/09)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: Calculations of the KFK data used to develop the HSE model showed that the Henry-Fauske model significantly under-predicted the critical flow for low-pressure air/water data (P_K=3.64E5 Pa, α_K=0.96, T_K=287 K). Henry-Fauske predicts a flow of 0.0155 kg/s. Ransom-Trapp predicts 0.0752 kg/s, and is in good agreement with results from the homogeneous frozen critical flow model. The critical flow for pure air is 0.0245 kg/s. Both critical flow models agree with HEM when the fluid is changed from air/water to steam-water. This was found in RELAP5-3D version 2.4.2 plus updates; this affects all earlier and all later RELAP5-3D versions.

- **(09040, 7/09)**
  - REPORTED BY: Glenn Roth, INL
  - DESCRIPTION: Cards CCC3001 through CCC5999 of a MULTID component allow for internal junction control. Word 8 on that card series is the junction area factor. This was set to zero to make sure no radial flow was present in the model. The problem failed in input processing but only for the nearly-implicit option on the 201 card. The debugger describes a single floating point exception in subroutine COEV3D line 2438 [convf_(iziy) = convf_(iziy)*vsign]. This was found in version 2.9.2; this affects some earlier RELAP5-3D versions.
  - STATUS: IN-WORK (NAA) The problem no longer fails in input processing, but gets a thermodynamic property error.

- **(09042, 7/09)**
  - REPORTED BY: Rich Riemke, INL
  - DESCRIPTION: In running an AP600 problem with consistent noncondensable choking, the code hangs at time 2,051.01 s. The hang is not related to consistent choking. Diagnostic edits show that all 3 full backups without a time step cut are involved (flip-flop, noncondensable

appearance, water packing). This was found in version 2.9.1 plus updates; this affects some earlier and all later RELAP5-3D versions.

- **(09043, 8/09)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: An unphysical result was obtained after the accumulator emptied during LOFT Test L3-1, a SBLOCA. Countercurrent flow was calculated at the surge line junction, with gas flowing out of the accumulator and liquid flowing back in, near 2100 s causing a partial refill of the accumulator. The surge line is at a lower elevation than the accumulator, which means that the liquid is flowing uphill and the gas is flowing downhill; just opposite of what should occur. The code is probably misinterpreting the elevation change across the surge line. The unphysical behavior is corrected when the one-velocity option is applied at the junction. This was found in version 2.4.2is; this affects all earlier and all later RELAP5-3D versions.

- **(09045, 8/09)**
  - REPORTED BY: Glen Mortensen, ISL and Cliff Davis, INL
  - DESCRIPTION: The code currently has minor edit/plot variables for total mass in all systems (TMASS), mass error in all systems (EMASS), total mass in each system (SYSTMS), and mass error in each system (STSMER). There needs to be similar minor edit/plot variables for mass of vapor/gas, mass of liquid, energy of vapor/gas, energy of liquid, mass of boron, mass of total noncondensable gas, and mass of each noncondensable. This was found in versions 2.4.2 and 2.9.2; this affects all earlier and all later RELAP5-3D versions.
  - STATUS: ON-HOLD Glen has recently addressed many of the needed minor edit/plot variables; Glen's updates were submitted and will appear in version 2.9.5. There are a few minor edits/ plot variables that still need to be done, including the energy of vapor/gas, energy of liquid, and mass of each noncondensable.

- **(09051, 9/09)**
  - REPORTED BY: Bettis
  - DESCRIPTION: In running a system calculation, the vapor temperature in the pressurizer surgeline, at times, goes to over 6,000 F. This was found in RELAP5-3D version 2.4.1; this affects perhaps all earlier and all later RELAP5-3D versions.
  - STATUS: IN-WORK (RAR) Discussed the problem with Bettis; they got plots, which show the temperature goes up quickly (does not jump) and stays there for 5 s. Bettis is getting a restart just before the temperature rise and to use the 105 card to get diagnostic edits during the high temperature period.

- **(09056, 10/09)**

- REPORTED BY: Rob Roth, Electric Boat
- DESCRIPTION: The code is exhibiting supersonic velocities when the calculation is choked with noncondensables and using Card 1 Option 3. This problem is related to UP#04001. This was found in RELAP5-3D version 2.4.2; this affects perhaps all earlier and all later RELAP5-3D versions.
- STATUS: IN-WORK (RAR) Discussed the problem with Rob. The supersonic velocities are downstream of a valve. The noncondensable quality is small (1.0e-8), but it does get in the Card 1 Option 3 noncondensable choking logic in subroutine JCHOKE. Emailed Rob the improved description of the minor edit/plot variable 'sonicj' in Volume II, Appendix A of the manual that is in versions 2.6.2 and 2.9.3. Rob to read the section along with the referred sections in Volume IV, Section 7.

- **(10023, 2/10)**
  - REPORTED BY: Juan Carbajo, ORNL
  - DESCRIPTION: In running some space nuclear calculations, it was noticed that some of the thermodynamic and transport properties for NaK disagreed with some literature values. For a temperature of 850 K, the code's viscosity is 5 times higher, density is 10% lower, specific heat is 10% lower, and thermal conductivity is OK. This was found in RELAP5-3D version 2.4.1; this affects all earlier RELAP5-3D versions (including some RELAP5/MOD3 versions) and all later RELAP5-3D versions.
  - STATUS: IN-WORK (RAR) Scott Lucas had previously received an email via Jim Werner (INL) from Lou Qualls (ORNL) indicating that Juan was having some of these problems. Discussed the problem with Cliff Davis. He suspects the viscosity problem is a bug. He indicates he also saw specific heat being lower (by about 8%) in the code for Na; he presented these results in an applicability presentation (IRUG seminar, Aug 2006, this is on the RELAP5-3D web site) and an applicability report (externally-released document, July 2006) on RELAP5-3D for thermal-hydraulic analyses of a sodium-cooled actinide burner test reactor. Cliff later put together an internal revised Na property generator based on ANL 1995 correlations that corrects the problem. I passed this info on to Juan and Scott. Juan called to say his manager, Lou Qualls (ORNL), believes NASA has some funds to fix this problem in RELAP5-3D and that ORNL may be able to get the funds. Juan indicated ORNL needs an estimate to fix this. Met with Jim Wolf and Cliff Davis (lead on fluids properties); Cliff provided a time estimate on this. Jim then prepared a dollar estimate and emailed it to ORNL. Juan emailed to indicate that ORNL has decided to modify the NaK fluid generator themselves. Discussed this with Juan; ORNL has the ATHENA code (based on RELAP5/MOD3.1 from 1993) in source form, which has the generators for the various fluids (including NaK); ORNL plans on using this. Juan agreed that ORNL could modify the NaK fluid generator based on RELAP5/MOD3.1 and then the new 'tpf' file (with improved specific heat and density) might work in RELAP5-3D;

he indicated that the code's viscosity, however, is calculated in the 'relap' directory subroutine VISCOS and a change in this could not easily be incorporated into RELAP5-3D. Cliff Davis and I discussed this with Jim Wolf; Jim talked to Phil Sharpe about this. Phil and Jim want Cliff to fix the viscosity problem before the code goes to Bettis and IRUG; Cliff fixed the error (use the variable 'tm6' rather than the variable 'tm3' for both NaK and potassium in subroutine VISCOS); Cliff submitted the update so it will appear in version 2.9.5. Nolan Anderson will make a modified version 2.4.1 with the subroutine VISCOS fix, and he will then send the modified PC executable to ORNL for them to use; the NaK density and specific heat problems in the NaK fluid generator still need to be fixed.

- **(10030, 3/10)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: In running a modified 3dflow.i installation problem (3dflow.i, that has 9 junctions connected to 1 time-dependent volume), the code fails with a thermodynamic property failure at the minimum time step with both solvers; BPLU (with the fix to UP#06061) fails on vapor case 14 and MA18 fails on vapor case 8. All vapor cases with both solvers have large cross flow and take more time steps that the other cases. In running the modified 3dflow.i installation problem on RELAP5/MOD2.5, the code runs all 18 problems with the MA18 solver; the BPLU solver was not available in RELAP5/MOD2.5. For RELAP5/MOD2.5, all vapor cases with MA18 have small cross flow and take the same small number of time steps as the other cases. This was found in a modified RELAP5-3D version 2.9.4; this affects some earlier RELAP5-3D versions and possibly some RELAP5/MOD3 versions.
  - STATUS: IN-WORK (RAR) Currently examining the problem.

- **(10035, 4/10)**
  - REPORTED BY: Glen Mortensen, ISL
  - DESCRIPTION: In running the typical PWR input deck, mass error was seen in the secondary side separators. Plots indicate the code is over-extracting liquid from the separators, which is causing the mass error. This was found in a modified RELAP5-3D version 2.9.3; this affects some earlier RELAP5-3D versions and all later RELAP5-3D versions.

- **(10036, 5/10)**
  - REPORTED BY: Paul Bayless, INL
  - DESCRIPTION: The capability to model different thermal conductivities for conduction in the axial and radial directions within a heat structure is needed when using the 2-D conduction model. This will allow modeling of some non-homogeneous materials and will allow proper accounting of input modeling compromises related to geometric limitations (e.g. modeling hexagonal blocks with a cylindrical structure). Suggested implementation options are either a user-input multiplier for the axial

conductivity or allowing input of an axial thermal conductivity table to complement the radial thermal conductivity input (the latter option would provide more capability). A more general option on the multiplier would be to allow values to be input for both the radial and axial directions; this would allow multiple structures to use the same base material property input. This was found in RELAP5-3D version 2.9.4; this affects earlier RELAP5-3D versions back to and including version 2.7.0; this affects all later RELAP5-3D versions.

- **(10038, 6/10)**
  - REPORTED BY: Bettis
  - DESCRIPTION: In running system calculations, there is a need to generalize the time-dependent volume and time-dependent junction input to allow the user to pass time-dependent volume/junction data via control variables (rather than use the CCC201-CCC299 cards). Bettis will provide the updates to INL. This was found in RELAP5-3D version 2.4.1; this affects all RELAP5 and all RELAP5-3D versions.
  - STATUS: IN-WORK (RAR) Currently helping Bettis with coding questions.

- **(10042, 6/10)**
  - REPORTED BY: Rich Riemke and Nolan Anderson, INL
  - DESCRIPTION: During the testing of the nearly-implicit water packing updates for version 2.9.3, the following problems were found: (a) the fill problem with a large maximum timestep of 1.0 s using the nearly-implicit scheme has a spike at 2.8 s, (b) The fill problem with a small maximum timestep of 0.05 s using the semi-implicit scheme has a spike at 8.1 s (this did not appear in RELAP5/MOD2), (c) the DA problem LOFT L2-5 3D using the semi-implicit scheme shows a different trip time for trip 509 when comparing calculations with and without the update. This was found in RELAP5-3D version 2.9.3 plus updates; the semi-implicit scheme problem affects some earlier RELAP5-3D versions.
  - STATUS: IN-WORK (RAR) Currently examining the problems.

- **(10051, 8/10)**
  - REPORTED BY: Rich Riemke, INL
  - DESCRIPTION: During F95 conversion, the heat structure vectorization coding in the reflood/2D conduction subroutines was removed because a pre-vectorization version of the code was used to do this part of the conversion. The vectorization coding needs to be put back in. This was found in RELAP5-3D version 2.4.1; this affects some earlier and all later RELAP5-3D versions.

- **(10052, 8/10)**
  - REPORTED BY: Glen Mortensen, ISL
  - DESCRIPTION: In running the typ1200.i input deck and examining plots

of the mass error in systems 1 and 2, the case using the h2on steam tables exhibits strange behavior compared to the default h2o steam tables and the h2o steam tables with Card 1 Option 71. For most of the transient, the h2on steam tables show larger and more oscillatory mass error. This user problem is for the whole transient; UP#10035, which was previously reported, is for system 2 around 15 seconds. This was found in RELAP5-3D version 2.9.5; this affects some earlier and all later RELAP5-3D versions.
    - STATUS: IN-WORK (RAR) Continuing to examine the problem.

- **(10059, 9/10)**
    - REPORTED BY: Bettis
    - DESCRIPTION: In running a system calculation with the Appendix K option, it was found that the heat transfer Appendix K models in subroutines CHFAPK and PSTDNB require the user to connect a heat slab to a hydro component (normally a pipe) that has the following restrictions: (a) The hydro component must be vertical with an inclination (vertical) angle of +90degrees, (b) There must be only 1 junction connected to the bottom of the hydro component. Initially, the Appendix K section of the manual needs to be changed to indicate these restrictions. Later, the coding and the manual need to be changed to be more generalized and thus to remove these restrictions. This was found in RELAP5-3D version 2.6.2; this is in all later RELAP5-3D versions.
    - STATUS: IN-WORK (RAR) Discussed the problem with Bettis. The Appendix K section of the manual was changed to indicate these restrictions. Next, the generalization of the coding and the manual needs to be done.

- **(10061, 10/10)**
    - REPORTED BY: Floyd Dunn, Argonne
    - DESCRIPTION: The code has a failure after onset of significant voiding in low pressure (1-2 atm) boiling. This was found in RELAP5-3D version 2.4.1.

- **(10064, 11/10)**
    - REPORTED BY: Paul Bayless, INL
    - DESCRIPTION: The capability to model both radiation and conduction from a heat transfer surface is requested. Both heat transfer mechanisms can be important in transient analysis of high temperature gas-cooled reactor accidents. The code currently limits the user to one mechanism per structure surface. This was found in RELAP5-3D version 3.0.0; this is in all earlier and all later RELAP5-3D versions.

- **(10065, 11/10)**
    - REPORTED BY: Paul Bayless, INL

- DESCRIPTION: A heat transfer package appropriate for helically-coiled tubes is needed. Several of the new reactor designs, including NGNP and NuScale, use helically-coiled tube bundles in their steam generators. Convective heat transfer is enhanced in helical coils compared to straight tubes, and dryout occurs later. There may also be differences in the heat transfer on the outside of the tube bundle that should be included as an option in the code. This was found in RELAP5-3D version 3.0.0; this is in all earlier and all later RELAP5-3D versions.

- **(10069, 12/10)**
  - REPORTED BY: Paul Bayless, INL
  - DESCRIPTION: There appears to be a problem with the nearly-implicit scheme in the annular mist flow regime. In most of the developmental assessment cases, the semi- and nearly-implicit schemes yield very similar results. However, for Moby Dick, this is not the case for the default code (see attached Figure 1). If card 1 option 55 is turned on, the semi- and nearly-implicit results converge (see attached Figure 2). The implication is that option 55 avoids some problem in the base coding. Moby Dick is an air-water two-phase flow test, so the noncondensables may also affect the problem. This was found in RELAP5-3D version 2.4.2; this is in some earlier and all later RELAP5-3D versions.

- **(11003, 01/11)**
  - REPORTED BY: Paul Bayless, INL
  - DESCRIPTION: It is requested that the user be able to input the height of heat structures when the axial conduction model is being used, overriding the code's use of the right boundary volume length.
    The code currently uses the length of the right boundary volume in the reflood and 2-D conduction models. In the gas reactor models, there are several locations where it is desirable for multiple axial structures within a heat structure geometry to be connected to the same boundary volume. With the current coding, this results in heat structure lengths that are too long, which in turn results in much lower axial conduction than should be occurring.
    A suggested implementation is to enter -3 as the reflood flag on the 1CCCG000 card to indicate that the user is going to provide the length of each structure. This length would then be input as word 6 on the 1CCCG6xx cards, with the heat structure number moving to word 7.

- **(11014, 04/11)**
  - REPORTED BY: Masaaki Katayama, MHI
  - DESCRIPTION: An MHI engineer was running large-break LOCA calculations with the Ransom-Trapp critical flow model. The engineer reported that the critical flow model intermittently unchoked early in the LOCA, which caused artificial changes in the break flow and lead to code failures in calculations with a system model. The intermittent unchoking

was replicated with a simplified model. The MHI engineer proposed changes to the choked flow logic that eliminated the intermittent choking and the code failures.

- STATUS: IN-WORK (CBD) The proposed change eliminates the first test for subcooled choking (see Page 7-45 of Volume 4 of the 2.4 manual) and the VC < 0.5*AAT*SOUNDE(KK) test for two-phase choking (see Page 7-49). A simple fix was developed that caused the code to evaluate the choking logic more often in both the subcooled and two-phase regions. The fix was to bypass the second choking test if quale was greater than 0.01, rather than 0.0, in the subcooled logic and to add the same quality test in the two-phase logic. The simple fix corrected the unchoking problem in MHI's test case, but made the LOFT L2-5 problem run worse on Version 242is during the reflood phase. The LOFT L2-5 problem failed in Version 300ie with the simple fix due to choking in sequential junctions during the reflood phase. The Dukler CCFL problem also ran much worse with the simple fix. However, the simple fix had almost no effect on the Dukler results in Version 242is. This suggests that there may be a problem in the choking logic in Version 300ie. Based on the results obtained to date, it is not recommended that the simple fix be implemented in RELAP5-3D.

- **(12001, 1/12)**
  - REPORTED BY: Cliff Davis for Gene Sosnovsky, Terrapower
  - DESCRIPTION: An external user reported a problem in which the code would not properly handle noncondensables with liquid metals. The test fails shortly after initialization in a case with noncondensables above lead bismuth. A similar problem was reported for sodium.

- **(12007, 2/12)**
  - REPORTED BY: Nolan Anderson for Fabrizio Magugliani, Ansaldo Nucleare
  - DESCRIPTION: A large test case with 3D components and nodal kinetics fails when run both as a transient and as a steady-state problem. The transient problem fails in subroutine FLUX3D with a core dump; this is associated with variable 'vdely'. The steady-state problem fails in subroutine TSETSL with an error message indicating that there are too many nonzeros. This message prints because ipr(ij+1) – ipr(ij) > 59. This (59) is a hardwired number that needs to be addressed.
  - STATUS: IN-WORK (NAA) Found an index error in the setting of variable 'vdely' in subroutine R3DCMP, that appears to be due to the F90 conversion. Fixed this index error and the problem now runs in transient mode. The steady-state problem fails in subroutine COEV3D which is due to a divide by 0. This problem is still outstanding.

- **(12008, 3/12)**
  - REPORTED BY: Cliff Davis for Gene Sosnovsky, TerraPower

- DESCRIPTION: The code fails during execution when two stagnant, vertical pipes that are connected by a closed valve are modeled. The lower pipe contains lead-bismuth and the upper pipe contains noncondensable. The pipes are initialized with no flow and constant pressure. The correct solution in both pipes is a pressure gradient that depends only on the hydrostatic term that should be obtained within 0.1 s. The code runs correctly when the transnt option is used, but fails when the stdy-st option is used. The code runs with the stdy-st option if the closed valve is deleted and the two pipes are modeled as separate systems. The code also runs if the 107 card is used to allow the code to use the semi-implicit option. The problem may be related to the use of the nearly-implicit scheme with the stdy-st option. The external user also reports that the original problem runs if lead-bismuth is replaced by water.

- **(12010, 3/12)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: In using the nearly-implicit scheme, found that numerous index variables are used with values 0, -1, and -2. These are indices of variable ‘mapa’ used to create new indices of the coefficient matrix. Depending on how these (and perhaps other) locations near ‘mapa’ are set and used, this could cause incorrect results.

- **(12016, 6/12)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: The Appendix K choking logic is set up only for the semi-implicit solution scheme. The derivatives necessary to use the nearly-implicit scheme were not included in the original INER coding. As a result, the critical flow rates can be off by more than an order of magnitude if the nearly implicit solution scheme is used. The current Appendix K coding also smoothes the critical flow rate with relaxation factors of 0.1 and 0.3, which were the same factors used in the Henry-Fauske coding when the Appendix K model was developed. However, time-step independent relaxation factors are now used in the Henry-Fauske model. The relaxation factors used in the Appendix K coding should also be updated to the time-step independent formulation.
  - STATUS: IN-WORK (CBD) Cliff added the coding for the nearly-implicit routine, but the relaxation factors still need to be updated.

- **(12024, 8/12)**
  - REPORTED BY: David Caraher, ISL
  - DESCRIPTION: The rate of interfacial area change was found to be unreasonable (~6 million m^2/m^3). This behavior can result in poor behavior of models which use interfacial area.
  - STATUS: IN-WORK (NAA) Verified that the interfacial area changes very rapidly in some cases. Looking at the coding further.

- **(12026, 8/12)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: SLOW PVM SLOWDOWN: If a RELAP5-3D run quits w/o informing PVMEXEC, it takes 60 sec for the Exec to time out waiting for a message and another 60 sec waiting for a handshake message (from the run that quit) from the shutdown message it sends. R5-3D/PVMEXEC sends no message to the screen user sees strange O/S messages: libpvm: upkint … that does not help in debugging.

- **(12027, 9/12)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: When installing with ifort 12.1.1, a problem fails in input processing w/numerous out of range error messages from subroutine ISTATE. Further investigation shows that H_2 (which it uses) and N_2 both produce a large number of NaN's in the *.pr files.

- **(12029, 9/12)**
  - REPORTED BY: Paul Bayless, INL
  - DESCRIPTION: When a failure to converge is encountered in the Gambill-Weatherhead CHF correlation, an error message to that effect is printed in the output file, then the code calculation terminates. It would be better if a debug printout and final major edit were printed after the error message. The error message would probably also benefit from having 0******** on that line.
  - STATUS: IN-WORK (NAA) Verified that the error message is printed, looking at adding the debug printout, final major edit and the traditional error message.

- **(12030, 9/12)**
  - REPORTED BY: Rodolfo Vaghetto, Texas A&M
  - DESCRIPTION: In running a transient restart from a steady-state, the transient fails due to a thermodynamic property error. If the transient is restarted from a previous stable restart time, the problem runs quite a bit further. This indicates that the restart is not identical to the intermediate time, which it should be.
  - STATUS: IN-WORK (NAA) Tried adding diagnostic edits for the intermediate time and the 2^{nd} restart. The differences in the outputs indicate that the scratch variables are different. It is unknown if this is significant, or if the variables just have not been necessary at this point in the 2^{nd} restart.

- **(12032, 10/12)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: An external user reported a problem using the Dowtherm fluid as the code failed when the bulk temperature dropped below 318 K. The minimum value contained in the stgdowa.i file is 318.15 K, even

though the triple point temperature is 285.15 K. The root cause of the problem is that the vapor pressure data contained in the brochure from Dow has no vapor pressure data below 300 K and only one significant digit below 318 K.
    - STATUS: IN-WORK (NAA) Added 4 additional temperatures to the tpf file that allow the fluid to be used down to 298.15 K. The fluid will not work below 10 Pa, and probably shouldn't be used below 20 Pa. To improve the DowTherm A fluid additional data will be necessary to improve the saturation line.

- **(13007, 02/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Changed restart frequency on 201 card from 2000 (only dump at card endtime) to 250 (write @ 2.5 sec). On restart, verification file shows NO DIFFERENCES on first restart step, but Vf and Vg are different on advancement two, and on final advancement, RHSth is different. Differences are in final bits only.
    - STATUS: IN-WORK (NAA,GLM) Found that the differences are due to small differences in variable 'timehy'. George came up with an update, but it needs refinement for PVM problems.

- **(13009, 02/13)**
    - REPORTED BY: George Mesina for Bettis
    - DESCRIPTION: On a restart when "allvols-1" is requested, the actual problem answers change and they change after a single timestep.

- **(13018, 03/13)**
    - REPORTED BY: Cliff Davis for Bettis
    - DESCRIPTION: The level.i file tests the level stack connection rules contained in Volume 1 of the code manual. The problem contains two parallel pipes, each of which uses the mixture level tracking model. A junction is used to connect the two parallel pipes. The problem simulates 36 cases that test each possible combination of from/to face connections. The number of level stacks calculated by the code disagrees with the connection rules contained in the manual for 10 of the 36 cases. The code logic should be modified to be consistent with the code manual or the manual should be corrected to accurately describe the actual connection rules. Related user problems are UP 08017, 08042, 10014, 12001, and 12008.
    - STATUS: IN-WORK (NAA) Found that the coding and the manuals do not agree, working on modifications to the coding.

- **(13021, 04/13)**
    - REPORTED BY: Nolan Anderson for Suthee Wiri
    - DESCRIPTION: A user reported that the vapor temperature in a problem running R-134a increased significantly in 2-phase flow. The cause is

unknown, but is speculated to be due to the interpolators, or the fluid itself.
    - STATUS: IN-WORK (NAA) Checked the interpolators and tried a similar problem with water, and saw the same issues. It is believed that the problem is with the condensation heat transfer.

- **(13022, 04/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: The verification file reveals differences between Vf and Vg from “i0” to its restart “i1” on the first time step after restart. The difference in the hexadecimal digits occurs in the 20th and 21st digits respectively.
    - STATUS: IN-WORK (NAA) This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13026, 04/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Deck varvol2.i0 produces a verification file that differs with the verification file of varvol2.i1, its restart, only in the TH system RHS sum. This occurs only on the final step.
    - STATUS: IN-WORK (NAA) This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13028, 04/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: For the first case of the two-phase pump model input deck, called twophspmp in the verify suite, small differences in the last decimal places of all non-zero summed quantities in the last time step, but the first shows no differences.
    - STATUS: IN-WORK (NAA) This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13029, 04/13)**
    - REPORTED BY: George Mesina, INL
    - DESCRIPTION: Deck jetpmpm.i1 reads to the end of the restart file without finding the record (Adv. 600 @ 30.0) that is marked as being written by : jetpmpm.i0. Probable cause is in cmpmod.
    - STATUS: IN-WORK (NAA) Modified the restart read for the jetpump in module CMPMOD to match the restart write. This allowed the problem to run, however there are differences in the verification files. This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13030, 04/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: All summed quantities in the verification files of neptunus20m.i0 and neptunus20m.i1 differ both on the first step after restart and on the final step.
  - STATUS: IN-WORK (NAA) Found and corrected potential issues with the restart read for the pressurizer component. Also found that the use of variable 'vlev' as a temporary variable in subroutine LEVSKT resulted in a loss of the value of 'vlev' from the restart. Added an allocatable integer 'vcttmp' to hold the values of variable 'vctrlx' temporarily. This corrected the 'vlev' error. Then did a diff of the verification files and found them to still be different. This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13031, 04/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: All summed quantities in the verification files of pitch.i0 and pitch.i1 differ both on the first step after restart and on the final step.
  - STATUS: IN-WORK (NAA) Found that variables needed to be added to the restart read and write routines for module MSIMOD. Added variables 'm_rring1','m_rring2', 'm_rring3', 'm_rrids1', 'm_rrids2', and 'm_rrids3'. Also found that variable 'athrot' was being unconditionally reset in subroutine ICOMPN for inertial valves. Modified the coding so that 'athrot' would only be reset when a new inertial valve was entered. This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13036, 05/13)**
  - REPORTED BY: Peter Cebull, INL
  - DESCRIPTION: Running an input deck using an AVScript in SNAP and running it separately outside of SNAP gives different results.

- **(13037, 06/13)**
  - REPORTED BY: Scott Lucas, NuScale
  - DESCRIPTION: A user reported that results did not match when an l2-5 deck was run for 100 seconds and then the same deck was run for 50 seconds then restarted to 100 seconds. The results matched for the first 50 seconds then diverged on restart. This case was run with a debug executable. The user also reported that when the deck was run with an optimized executable, the results diverged before the restart began.
  - Found that variable 'hte' was previously set in subroutine MDATA2, but had been removed during the F90 conversion. Set variable 'hte' in subroutine MDATA2 as was previously done, and the plots from the two

runs show that the results lie on top of each other. The results are slightly different however. This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13038, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: RELAP5-3D version 4.1.1 + updates fails in idetector.f at line 46 when restarting typkindt.
  - STATUS: IN-WORK (NAA) Found that a pointer variable was not allocated for a restart. Allocated this variable on restart. The problem then ran, but there were differences. Found that the kinetics time step routine did not restart correctly. Variable 'lskpkin' was automatically reset on a restart, which caused differences. Changed the setting of variable 'lskpkin' so that it was only reset if the time-step cards were re-entered on restart. Found that there were still differences in the verification file. This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13043, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: All three cases of crit.i produce different L1-norms than the corresponding restart cases at both the first and final advancements. As time advances, the two Case 1 calculations converge. VOIDf, Uf and Ug agree to 16-byte precision at the end. The velocities and energies get closer in all cases. It seems there is something wrong with the restart write/read or the restart start up.
  - STATUS: IN-WORK (NAA) Found some errors in the restart input deck, corrected the errors. Found that there were still differences in the verification file. This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13046, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The first 3 cases have identical verification dumps. Case 12 has all L1 norms the same except RHSth on the last step. All 18 other cases have identical dumps on the first step but differ at the final advancement.
  - STATUS: IN-WORK (NAA) Some recent fixes in the verification file fix some of the errors. Found that there were still differences in the verification file. This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13048, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The first time step verification dumps differ in the last bit of Uf, Ug, Vf, Vg, and SOLth. On the final step the L1 norms agree to only 5 or 6 places.
  - STATUS: IN-WORK (NAA) This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13049, 06/13)**
  - REPORTED BY: Nolan Anderson, INL
  - DESCRIPTION: Found that restarts that use the MA18 and PGMRES solvers fail with a core dump in subroutine TSETSL.

- **(13053, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Difference in last decimal place of several L1-norms. This may be resolved with the timehy updates.
  - STATUS: IN-WORK (NAA) This problem is related to UP#13007. The observed differences are due to small differences in the calculation of variable 'timehy'. This needs to be investigated further.

- **(13054, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: All five cases of valve restart with velocities differing by 6 orders of magnitude in Case 1 and 7 in case 3 but are close in the other three cases. They get better or worse depending on the valve. One thing that could cause this would be the restart not having all important valve data on the restart file.
  - STATUS: IN-WORK (NAA) Found that the differences were due to errors in the restart deck. Corrected the errors, the problem fails with a glibc error.

- **(13057, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the duklerm.i case at the final timestep shows differences: Uf, Ug, VOIDf, QUALa, Vf, Vg, Error, and Cntrl are good to about 8 significant digits. Trips and dtsum match perfectly.

- **(13064, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the httest.i input deck at the final time step shows differences: Ug, dtsum, and Trips are perfect Ug, VOIDf, Vf, Vg, and Temp are good to about the last bit. Error is only good to 3 places.

- **(13067, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the neptunus20m.i input deck at the final time step shows differences: Uf, Ug, VOIDf, Vf, Vg, Error, and are good to 3-5 significant digits. Trips and dtsum match perfectly.

- **(13070, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the refbunm.i input deck at the final time step shows differences: Uf, Ug, Vf, Vg are good to about 9-10 significant digits. Temp is good to 5. Error is only good to 1. VOIDf and dtsum match perfectly.

- **(13071, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the reflecht.i input deck at the final time step shows differences: Most calculated values are good to 5-7 digits. Uf is only good to 3. Error is only good to 1. VOIDf, Cntrl and dtsum match perfectly.

- **(13072, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the rtsamppm.i input deck at the final time step shows differences: Uf, Ug, VOIDf, Vf, Vg, and Cntrl are good to 3-5 significant digits. Error is good to only 1. QUALa, Trips and dtsum match perfectly.

- **(13076, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the turbine9.i input deck at the final time step shows differences: Uf, Ug, VOIDf, Vg and Cntrl are good about the last bit. Vf are good to about 10 significant digits. Error is only good to 2 places dtsum matches perfectly.

- **(13077, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Comparing Base and "backup after every successful step" runs for the valve.i input deck at the final time step shows differences: Uf, Ug, Vf, Vg are good to about the last bit. Error is only good to 6 places Cntrl and dtsum match perfectly.

- **(13078, 06/13)**

- REPORTED BY: George Mesina, INL
- DESCRIPTION: The backup state.i input deck fails in Case 7 (both base and restart decks run all 24 cases) at plotmod.f line 797. The following message is: *** glibc detected** * ../../../relap/relap5.x: malloc(): memory corruption: 0x00002b016e505010 *****

- **(13079, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The backup ans.i input deck fails in Case 6 (both base and restart decks run all 9 cases) at plotmod.f line 797. The following message is: *** glibc detected** * ../../../relap/relap5.x: malloc(): memory corruption: 0x00002ad4c8691010 *****

- **(13083, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The restart input fric.r.i deck fails in Case 13 of 14 at plotmod.f line 797. The following message is: *** glibc detected** * ../../../relap/relap5.x: corrupted double-linked list: 0x000000000111b680 *****

- **(13085, 06/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: The restart httest.r.i input deck fails in Case 9 of 9 at plotmod.f line 797. This is DIFFERENT from UP#13040 which failed in case 6. The following error message is given: *** glibc detected** * ../../../relap/relap5.x: malloc(): memory corruption: 0x00002af186da7010 *****
- **(13086, 06/13)**
  - REPORTED BY: Steve Piet, INL
  - DESCRIPTION: When the code is released to the IRUG, some members will have Windows 8 platforms. (1) We need to warn users to install on Windows 7 platforms OR (2) we need to add the capability to install on Windows 8. We do have MS Visual Studio capable of building a Windows 8 distribution, but it is installed on Windows 7 computers for lack of a Windows 8 machine. Our Intel compilers will work on any recent Windows platform.

- **(13087, 07/13)**
  - REPORTED BY: Scott Lucas, NuScale
  - DESCRIPTION: An external user reported that the Osmachkin CHF correlation was not documented in the RELAP5 manuals. This needs to be added.

- **(13088, 08/13)**
  - REPORTED BY: Cliff Davis, INL
  - DESCRIPTION: A simulation of the LOFT L3-1 experiment showed that the break flow rate increased significantly after the accumulator emptied

and noncondensable nitrogen reached the break. The experiment did not show a corresponding increase in the break flow rate. The problem was traced to updates that were implemented in 2009 to make consistent calculations of volume and junction sound speed in the presence of noncondensables. The problem disappeared when Card 1 Option 3 was turned on, which caused the code logic to return to that used prior to 2009. A simple three-volume test case, which demonstrates the effect of Card 1 Option 3 on the break flow, has been stored on the cluster at /projects/r5dev/cbd/errors/noncon/break.i.

- **(13090, 08/13)**
  - REPORTED BY: George Mesina, INL
  - DESCRIPTION: Case 5 of 9 cases of the ans.i problem causes code failure when restarted with input deck ans.r.i which restarts all 9 cases on RELAP5-3D/Version (original coding and with updates). The code was built on the SUN Java Station using intel Fortran 11.1.
    This restart deck ran all 9 cases to completion in version 4.1.2t + updates on the same computer but with compiler level 10.1.

- **(13094, 08/13)**
  - REPORTED BY: Clay Dai, INER
  - DESCRIPTION: Activating reflood calculation in certain cases may result in the violation of mass conservation. We still could not work it out.
    Clay provided a graph of the mass error issue, but no input deck.
    The level and type of compiler and operating system are not reported.

- **(13095, 08/13)**
  - REPORTED BY: Bettis
  - DESCRIPTION: A collection of varying volume problems fail in different ways. These problems all have a volume that is expanded then compressed to the starting volume. This probelm occurs in an older version of RELAP5-3D.

- **(13096, 08/13)**
  - REPORTED BY: Dan Ludovisi, Sargent & Lundy, LLC
  - DESCRIPTION: Non-realistic results are seen in a model for a long segment of pipe (it takes a while to run it). As can be seen in an attached PDF, the force calculated between junction 42 and junction 61 in pipe 43 appears to be erratic starting from 18 sec to 35 sec. This is most likely due to a rapid cyclical switching in flow regimes in pipe 43, and it is reduced with an increase in L/D ratio.